Practical Computing

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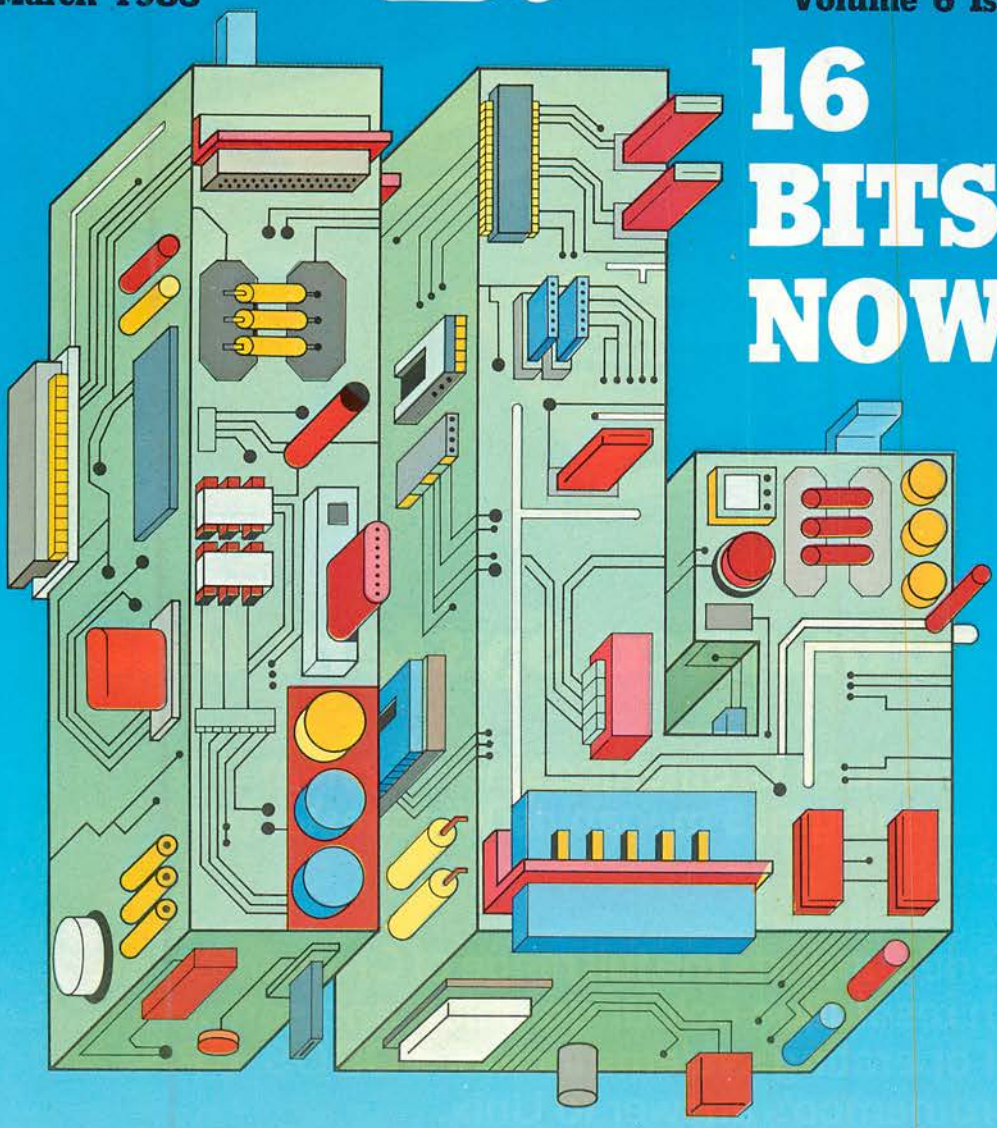

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Lisa — Apple's revolutionary micro

BBC/Atom DIY graphics digitiser

Computing on the train

The Lynx on test — it's no toy

Cromemco System One

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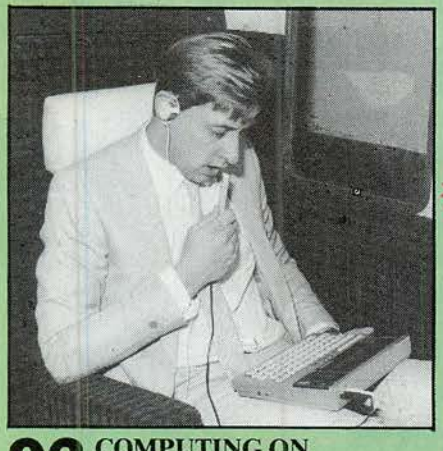

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Safeguarding whose data?

GOVERNMENTS have a habit of trying to "manage" the news, and the timing of controversial bills is one way to do so. It was no surprise, then, that the Home Office's Guidance Note on the Data Protection Bill arrived on the editorial desk on Christmas Eve.

British governments have a bad record when it comes to secrecy. Vast mountains of innocuous and often irrelevant "secrets" are expensively kept secret from the Great British Public — though not, apparently, from any foreigners who want to know, as the recent spate of "spy scandals" amply testifies. Now you might think this would make them keen on having a comprehensive data-protection bill. Not a bit of it. It looks as though the government has been pushed into tabling the current bill only for commercial reasons.

What interested parties such as the British Medical Association want is a fully-fledged data-protection authority, as was recommended by the Lindop Report in 1978. This DPA would naturally want to guard against the misuse of all data, including written records, as medical records are by and large still not computerised. The government certainly does not want a powerful Lindop-type DPA. A cynic might suggest this is because the government's own agencies are among the main misuers of such data. In any event, the data-protection bill now scheduled for Parliament only applies to data held on computers.

The commercial reason for this is that the bill represents the minimum that will enable the U.K. to ratify the European Convention for the Protection of Individuals with regard to Automatic Processing of Data, which we have already signed. Without this ratification, British companies stand to lose millions of pounds worth of business processing data for other EEC countries.

There is another way in which the bill will benefit the British computer industry: hardware and software will have to be modified to meet its conditions. According to the financial memorandum which accompanies the bill, the government will have to spend £5½ million on this in the first two years. Local authorities and other public bodies will probably have to spend around four times this amount. The cost to private companies could be enormous.

The bill says, "appropriate security measures shall be taken against unauthorised access to, or alteration, disclosure or destruction of, data and against accidental loss or destruction of data." The computer expert who can guarantee that kind of security stands to make a fortune.

The subject of data items is allowed access "at reasonable intervals and without undue delay or expense", and to have data corrected or erased. However, Part IV includes a large number of exceptions including that catch-all of "national security pruposes". Specific exceptions include data used for crime detection, the assessment of any tax or duty and immigration control. In addition, the Secretary of State is empowered to prevent a subject having access to health and social work data.

Home-computer users will be relieved to learn that they will not have to register their personal databases. As with home tape recording, the individual is beyond the reach of the law. And in any case, such data is not likely to prove damaging in the long run. But there is no reason why, for example, tax records or the Police National Computer should be similarly beyond the law. If they are, 1984 threatens to arrive right on cue.

5 Years ago...

This year's Intel Fair proved to be more than just the formal announcement of the Intel 8086 microprocessor.

There were some important announcements on new software available for the now-established 8080 microprocessor and some impressive exhibits.

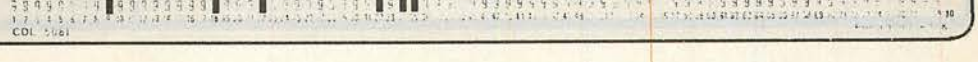
The 8086 is the highest-performance Intel computer to date, and, claims Intel, "capable of providing a performance equivalent to today's top-of-the-range minicomputers".

The 8086 is source-code compatible with the 8086A and with 8085 via a translator package which will convert most of the 8080/8085 source code into code for the 8086.

The 8086 provides all the features of the 8086A plus 16-bit arithmetic, signed eight- and 16-bit arithmetic (including multiply and divide), interruptible byte string operations and improved word manipulation.

Also included are such minicomputer-type features as re-entrant code, position-independent code and dynamically relocatable programs.

For commercial applications the 8086 is capable of addressing just over one megabyte of memory, by means of a bank of registers designated the segment register file which is used to augment the 8080-like 16-bit (64K) addressing capability. Basically four bits are added to the addressing signals which allow for the selection of 16 64K segments.



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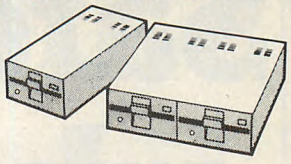

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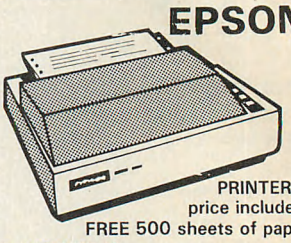

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3 2768M	150	24 930M	325
3 57594	98	48 0M	175
3 6864M	300	100 0M	375
4 0MHz	150		
4 433619	100		
5 0MHz	160		
6 0MHz	140		
6 144MHz	150		
6 5536M	200		
7 0MHz	150		
7 168MHz	160		
7 68MHz	200		
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Avoiding the cowboys

LAST YEAR I began to consider the purchase of a microcomputer. Bearing in mind what I wanted to do and how much I could afford, the Sharp MZ-80B with a P6 printer and twin floppies emerged as the system I should buy. I read all I could about the equipment, and not a bad word was written: flexible, very reliable, a winner if ever there was one. "This sounds like the one for me", I thought.

Because I was unsure from where to buy the equipment — I was looking for a reputable supplier who could, if things didn't do quite as they should, provide the necessary service to put things right — I wrote to Sharp who subsequently advised I consult a particular dealer. I visited the dealer, and being satisfied to that point placed an order.

The equipment was delivered a little late — but never mind, it's my new toy. Within six days the printer packed up: the printer head moved across the roller, but the pins wouldn't fire. I returned the printer and within two days got it back. Hurray! Within ten minutes the printer failed again. This time the dealer collected it. After seven days I got it back again. On each occasion the printer was returned to Sharp at Manchester for repair. The dealer didn't seem to know how to repair it, even though it was alleged only to be a fuse on the first occasion.

Surprise, surprise, another seven days — you guessed it, the printer failed again. To add insult to injury, the dealer suggested that the processor was at fault and was causing the printer to fail. This from someone who couldn't even mend a fuse.

At this I wrote to the dealer and to Sharp, sent the lot back and placed the matter in the hands of my solicitors. That was the beginning of June. They're still trying to sort out the mess.

However, upon making further enquiries I still receive noises that MZ-80Bs are reliable, fantastic and all that. Since the MZ-80B had the spec I was seeking I thought: "Well, the one I had might just have been one of the last they made on a Friday afternoon — even if it was made in Japan." So I sent out 10 enquiries to all parts — from Aberdeen to Newton Abbott — to all those who I could find who advertised they supply MZ-80Bs. Only five bothered to reply even though a replied-paid envelope was included.

I thought it would be a good idea to see a system up and running — ideally one of those many satisfied user I keep hearing so much about. Of the first three dealers I approached the idea of giving away customers' telephone numbers is definitely against policy. Although I still continued to hear fantastic noises praising Sharp systems, no one was able to produce one.

What do you have to do in this world to buy a micro without running the risk of being taken for a ride? All I want is a micro that will do the things people keep on saying it will do.

J W. Russell.
Cannock,
Staffordshire.

● **Mr Russell finally purchased an MZ-80B from a local camera shop for £886 including VAT, but it is unable or unwilling to supply discs and a printer. He is still looking for them.**

Commercial software

THE PATENT LACK of understanding of British industry in *Practical Computing's* January editorial goes a long way to explain why computers have not generally been used industrially at anything other than the essentially trivial order-processing or accounting level.

Contrary to your assertion — or more accurately the NCC's, which you endorse — most middle managers, at least in the engineering industry, are only too keen to use computers. The problem is that the computing industry has not delivered. There are two approaches to, for example, computerising production — the in-house and the package. Developing in-house software is prohibitively expensive. DP people might be paid an average £18,500, middle managers are most certainly not. The package approach is equally fraught: the vast majority of packages require company systems to adapt to computer industry-designed concepts rather than the reverse. A case of tail wagging dog?

The first company to produce a flexible materials-management system — or, more strictly, a meta system — can be assured of a large market. What is needed is a structure capable of assimilating existing, proven heuristics and running the result on a variety of mainframes and minis. Then watch things happen.

In the meantime, stick to your last. Micros are great toys but of little relevance to the mainstream industrial scene.

S. Zetie,
Maidenhead,
Berkshire.

Pub stocktaking

WE READ with interest the article, Stock Answers from a Husky in the January issue. We "trainers" do quite a lot of work with tenant and free-house publicans in the South-West, and we know several publicans who run their own stock-control programs using microcomputer equipment costing under £600 including printer and floppy disc.

Our personal experiences with the few publicans installing their own microcomputers — out of the 300-plus we have met in the last two years — are that it is the computer-enforced change of approach, from the slap-happy, leave it to next week, my accountant will do it approach, to the methodical routines required by the computer that brings about the real saving. The computer ensures stock is counted, checked and watched, and that theoretical takings coming from stock consumed, valued at bar-sale price-list value are regularly compared with actual takings.

God bless this black box, the computer. We have tried all ways to persuade publicans that stock control is probably more important than money control. The black box converts them in two minutes.

One point: why does the stock-taking profession still deal with dozens and tenths of dozens? Surely it is history, harking back to the time when valuations had to be carried out by ready-reckoners, etc. Our home-gown micro program converts dozens to units — it's only a two-line input. After all, in the pub trade a bottle is a bottle is a bottle, not a 1.2 bottle.

K Mayman and G Tarling,
Bristol Polytechnic.

BBC disassembler

ON ENTERING the disassembler program for the BBC Micro printed on pages 136 to 138 of the January 1983 issue of *Practical Computing* I found two mistakes, one obvious and one not so obvious, that readers may be interested in noting before getting too exasperated.

The first one occurs on line 260, where a portion of the line appears to be missing. The line should read:

```
260 DATA "A                ",
  "£&..  ", "&..           ",
  "&..,X ", "&..,Y  " "&....  ",
  "&.....X", "&.....Y",
  "                ", "&..  ", "(&..),X",
  "(&..),Y", "(&....)"
```

Each data string should contain seven characters including spaces.

The other mistake is on line 800 where the last number on the line should be 77E not 67E. This corrects op code 7E to

ROR nnn, X

not ROR nnnn as it would be if line 800 was left unaltered.

However, once corrected, the

(continued on next page)

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

(continued from previous page)

program runs beautifully, and very quickly. I find it very useful indeed.

Martin Cresswell,
Sutton Coldfield,
West Midlands.

● We apologise for the fact that part of line 260 went mysteriously missing. It was on the listing we sent for reproduction.

JOHN LEACH'S exellent disassembler for the BBC Micro published in the January issue can be made still more informative using these additions and amendments — see panel.

Operating-system calls are identified and labelled in the right-hand ASCII character column. Reducing the Tab settings in lines 1250, 1380 and 1500 by two or three positons will centralise the display on the screen.

Elvin Ibbotson,
Idridgehay,
Derbyshire.

Chalk and talk

IT IS UNFORTUNATE that in the editing of my article on Prolog for historical simulation published in the December 1982 issue under your title Revolution in Education you imputed to me views that I do not hold. You added an introduction: "Gone are the days of blackboards and textbooks if Richard Ennals' ideas catch on", implying that the use of microcomputers was intended to replace such conventional means of teaching.

The point of using logic in the classroom and logic as a computer language is to extend the student's learning capacity, providing a more powerful context for the use of blackboards and textbooks, which will have a role as long as children are taught in schools.

Richard Ennals,
Hampton,
Middlesex.

Humble pi

THE WRITER who described the Sharp PC-1500 in the survey of portables — January issue, page 101 — states that "divide 22 by 7 and π is approximated to 10 significant digits".

It is not. It is approximated to less than four significant digits. You can write as many or, indeed, whatever decimal digits after the first three as you or the computer pleases, but the approximation is no closer.

If you really want a rational fraction that approximates π to 10 digits, use 3,235,853 ÷ 1,030,004. Most people use the familiar and easily remembered 355/113, which is correct to six decimal digits.

R A Fairthorne,
Farnborough,
Hampshire.

"Primitive" misleading

THANK YOU for including details of our Addressbook mailing list package in the January issue of *Practical Computing*. While the facts quoted are accurate, I am rather concerned that your description of this software as "unashamedly primitive" may convey a somewhat misleading impression.

Addressbook is undoubtedly simple to use, but the capability has not been sacrificed to achieve this. In fact, the range of facilities provvided rivals that available in the "middle range" products to which you refer. Sophisticated selection, including "soundlike" comparison, sorting, updating and reporting facilities are all supplied as part of the standard product.

Addressbook owes its simplicity and power to the fact that it was produced using our Frontrunner application-generation package. Anyone looking for user-friendly data-management software for an application other than mailing-list management is advised to look at Frontrunner, which at £190 may well be the answer to their problems. They will certainly find that definition of data-entry forms, data-checking rules, etc. can be easy and straightforward.

Jenny Philips,
Decision Technology,
East Molesey,
Surrey.

United we stand

AS THE OWNER of a ZX Spectrum I am fed up with the running argument between Spectrum owners and BBC owners as to which is the best buy. It is obvioius to anyone with half a brain that the BBC is a better-quality machine than the Spectrum, but I can show that the Spectrum can be expanded to equal the BBC for less than the difference in price but at greater trouble.

The point is that both machines are British and as such it should be obvious to the owners of British machines that there are many imported machines on the market. The machines are claimed by their manufacturers to be, for example, "the finest home computer that money can buy" or "the Oric 1 is the professional alternative for home computing".

So let's stop stabbing each other in the back, or these other computers are going to attract sales from potential Sinclair or BBC buyers because the buyers don't want to get mixed up with the argument. This means that software and hardware will not have such a big market and will therefore cost more.

One final note. It has been suggested by many that the forthcoming Acorn Electron is intended to be a Spectrum beater. This is not the case. The Electron is primarily intended to do for Acorn wat the Spectrum or ZX-81 does for Sinclair. It is supposed to make money.

L Dundon,
Tidworth,
Hampshire.

Bad taste

I FIND your editorial in the January issue in somewhat bad taste. Like many others, you make assumption that information technology begins and ends with an underpowered microcomputer with no practical software.

There are a large variety of products on the market, and a recent promising trend for systems to be actually made in the United Kingdom rather than imported at inflated prices. Unfortunately a large amount hardware is totally unsuitable for use in a business environment, and the number of good program packages available is very small. Perhaps 1982 should have been named "the year of the computer cowboy".

Undoubtedly management would be willing to accept systems when they can see them working reliably, and will buy them from a supplier who will be in business in the future, can service the equipment when it breaks down, and employs staff who understand the requirments of an end user.

On another aspect of IT, if you wonder what has become of Prestel you might be interested to know why we are not selling it; British Telecom wants to charge us £275 to be registered, 15p per minute connect time, plus 70p per minute for the call on top of the charge per frame.

Finally I might add that I do sell microsystems, I am pleased to be a member of a professional body, the BCS. but am not married, have no children, and certainly do not live in Surrey.

Jim Watt,
Future Systems,
Gibraltar.

Spectrum security

FOR SOME MONTHS I have been using a code routine for the ZX Spectrum which incorporates the Line command. It occupies 245 bytes as it stands, but by reducing on-screen comments to a minimum it can be fitted into 117 bytes if memory is short. It has the advantage that any combination of characters can be used for the code, Z$, and it can be of any length.

It is also easy to change, so could be altered every day or every week if required. The number of attempts permitted can be varied by changing line 9994.

The main program starts at line 10, but must end with a Stop statement to prevent it running into the code routine. It should be Saved in autostart mode:

SAVE "name" LINE9990

It goes without saying that the

(continued on page 13)

BBC disassembler.

```
225 FOR I=1 TO 13: READ OS$(I), O$(I): NEXT
265 DATA OSFIND, & FFCE, OSGPB, &FFD1, OSBPUT, &FFD4,
  OSBGET, &FFD7, OSARGS, &FFDA, OSFILE, &FFDD,
  OSRDCH, &FFE0, OSASCI, &FFE3, OSNEWL, &FFE7,
  OSWRCH, & FFEE, OSWORD, &FFF1, OSBYTE, &FFF4, OSCLI,
  &FFF7
1510 IF NBYTE%<3 THEN 1540
1520 MO$=" ": FOR I%=1 TO 13: IF
  LEFT$($MOSHOW%,5)=O$(I%) MO$=O$(I%)
1530 NEXT : IF MO$<>" " PRINT MO$; : GOTO 1560
1540 FOR I%=1 TO NBYTE%: Q%=PCGET%(I%):
  IFQ%>=&20 AND Q%<&7F PRINT CHR$Q%; ELSE PRINT "
  ";
1550 NEXT
1560 PRINT " ": ENDPROC
```

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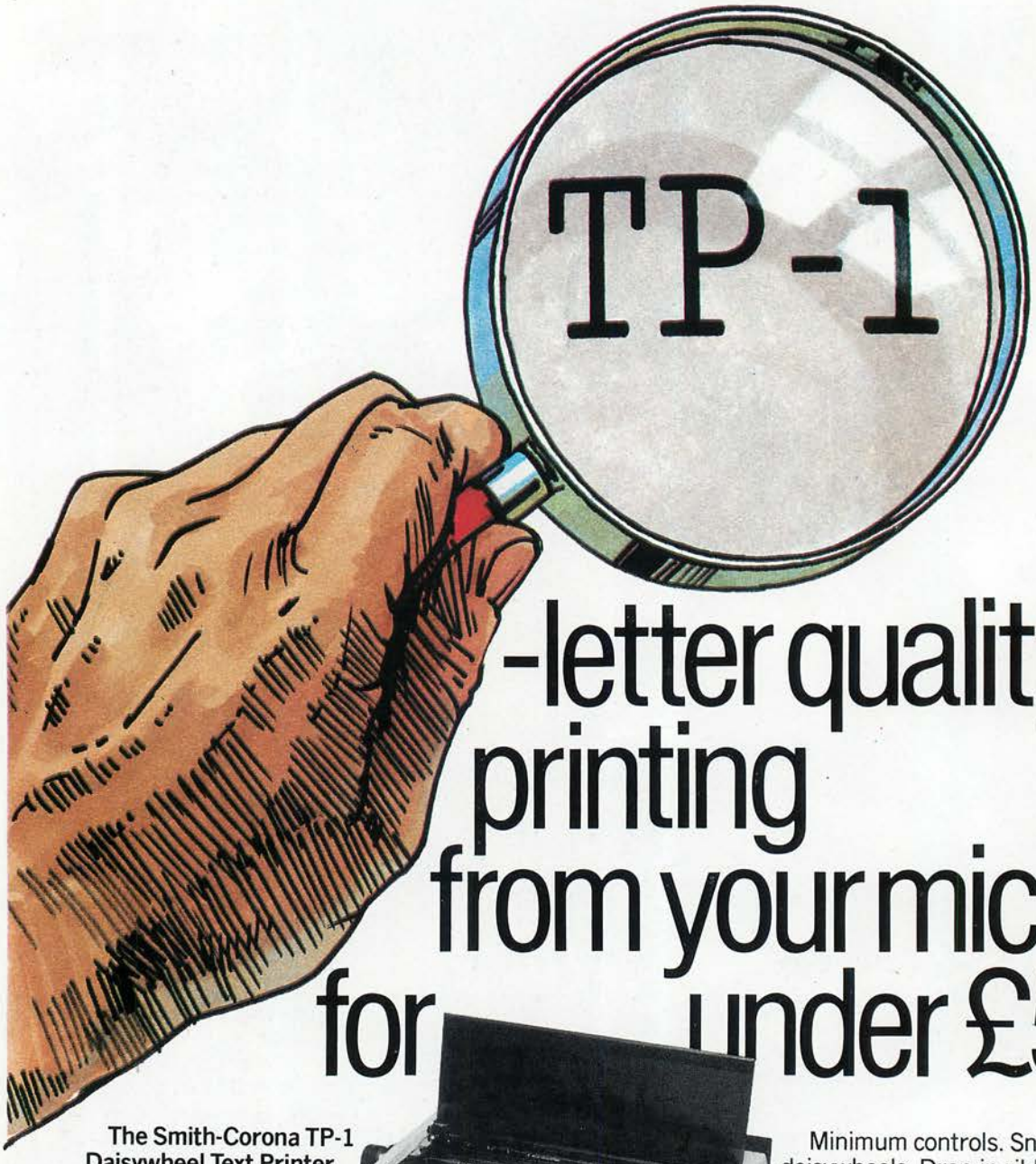

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Code routine.

```
9990 LETc = 0 : LET Z$ = "12345"
9991 PRINT "Enter code:-"
9992 INPUT LINE Y$ : CLS
9993 IF Y$ = Z$ THEN GOTO 10
9994 Let c = c + 1 : IF c > 1 THEN NEW
9995 PRINT "Not correct. Enter again!" : PRINT' ' ' '
9996 PRINT FLASH 1 ; "If not not correct this time program will be
   deleted."
9997 GOTO 9992
```

(continued from page 8)

code should be easy to remember. Using the first act of *Macbeth* will ensure that programs are very secure, but is a little prone to typing errors and lapses of memory.

W H Roberts,
Pencoed,
Mid-Glamorgan.

Knight's square route

I BELIEVE that the answer given to the November puzzle is not the best. The sequence:
2 + 3 × 5 × 7 × 8 × 9 × 4 - 1
gives the result of 50,399

Andrew Burton.
Tarporley,
Cheshire.

Spectrum supporter

AFTER READING Bill Nichols' letter in January's *Practical Computing* I decided to inform you of my experience with Sinclair. Mr Nichols' letter is completely truthful, in fact I received my Spectrum in 24 days.

In answer to Simon Clark's letter, I should like to say I am delighted with my Spectrum. I have used a BBC Micro often at school and find it very good, but I prefer the ZX Spectrum. Although, on paper, the BBC is the better computer, I find the Spectrum's Basic beautifully easy to use.

As for the criticisms of the keyboard and Basic entry, complaints are unjustified. The keys were a pleasant surprise and are nice to use. The Basic word entry is easy and very versatile, in fact more so than the ZX-81.

Robert Marsh,
Chesterfield,
Derbyshire.

Apple formatter

I EXPECT that by now Philip Colmer — Feedback, January 1983 — will have found a way round the two quirks that he describes in M J Parrott's Apple text editor. If not, he may like to try my solution.

To prevent Ctrl-L from incorrectly causing the program to rerun, change the JSR at line 45 from $FDED to $FDF0. This bypasses DOS so that the print instruction at line 45 cannot be misinterpreted as a DOS command.

If the program is to accept Ctrl-L, Cursor Return, as the last item of a line of text, it seems to me that it is first necessary for the program to be able to find out whether a CR read from the buffer is just that. If it is, then the program should treat it as simply another character in the line instead of forcing a reset. Changes to the source file will effect this. After line 136, insert:

```
137 INY
138 CPY TEXT
139 BEQ PATCH
140 DEY
```

After old line 151, now line 155, insert:

```
156 PATCH DEY
157 JMP PUTIT
```

W Anderton,
Hampton,
Middlesex.

Football crazy

ON PAGE 21 of January's *Practical Computing* you say that "pools prediction programs require data to work on, the more the better". While this is true of some programs it is certainly not true of all.

The former type operate on the principle that, if a given sequence of results occurred at some in the past then that same sequence is likely to be repeated this week.

A much more reliable method is based on current form, obtained easily from league tables and published sequences of recent results. Mayday Software currently offers such a program. It is called Predict and runs on the BBC Micro, models A and B and costs only £4.99.

Users can easily tune it themselves without any reprogramming by simply changing the weightings given to each prediction, thus constantly improving the predictions.

A G Ashley,
Mayday Software,
Stanmore,
Middlesex.

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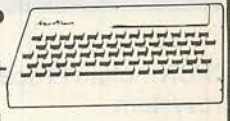

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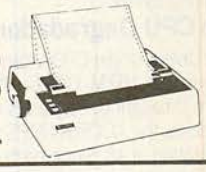

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● Circle No. 107

What can sixteen CP/M* users have in common?

17 Z80s running at 4 Megahertz
1 Megabyte of 200 Nsec RAM
18 Serial Input/Output Ports
1 Centronics-type Parallel Port
90 Megabyte Shared Cartridge Disks
2 Megabyte Shared Floppy Disks
4 Shared (Spooled) Printers
Optional Private Printers
Running under Standard CP/M 2.2

All in one box!

ACCRON—Multi Processor Series—Microsystem

The ACCRON–Multi Processor Series–microsystem is a breakthrough in low cost high performance multi-user S100 micro computers. Based on the Service/User Processor principle, a single ACCRON–MPS system supports up to 16 users, where each user has its own Z80A, 64KB RAM and an RS 232 I/O Port on a single S100 board. Each User Processor runs under its own dedicated copy of the CP/M operating system. All users share the common resources such as disks, magnetic tapes and system printers. These shared resources are controlled by the Service Processor with its own dedicated Z80A and 64KB RAM running under DPC/OS,* a proprietary Distributed Processing Operating System.

Zero CPU Degradation!

Unlike single-CPU timesharing multi-user systems (e.g. MP/M, OASIS, MVT-FAMOS etc.) where system throughput degrades as additional users are added, the ACCRON-MPS system has no CPU degradation at all. Since each user has its own self-contained processor and memory you can now have minicomputer performance at micro computer prices.

It's Expandable

You can start with a single-user floppy disk system and (field) upgrade it to multi-user by simply adding a Service Processor running DPC/OS and more User Processor boards as and when required. Large capacity hard disks, magnetic tapes and more printers may be added at any time without any hardware or software redundancy.

CP/M Compatible

Use of the industry standard CP/M operating system means that a wealth of readily available, reasonably priced, system and application software will run on your ACCRON microsystem without any modification. Upgrade to multi-user, where simultaneous access of shared data files is required, is easily supported by the inclusion of simple file or record locking routines.

User Friendly DPC/OS

The Service Processor and DPC/OS provide an easy to understand and user friendly interface for common access to shared resources such as disks, magnetic tapes, up to four spooled system printers or any other peripheral that may be attached to your system (such as a telex-tape punch). Simple routines handle record and/or file locking and prevent "interleaved" or "fatal embrace" file update sequences. DPC/OS allows for both private and shared disk space. Interprocessor message communications, scheduling and batch-submit facilities are also provided.

Complete Range of Peripherals

NEWTONS Laboratories prides itself in offering you the largest choice of microsystems presently made or distributed in Britain. Three distinctive ranges, based on 5-inch, 8-inch or 14-inch magnetic media, utilizing both sealed (winchester) or removable cartridge disk techniques are supported and available NOW! In addition, the ACCRON offers a full blown, industry standard, 9-track reel-to-reel magnetic tape subsystem. So you can store, retrieve and process vast amounts of data using standard 800 or 1600 BPI magnetic tapes that can also be used to interface with most major mainframe computers.

Maintenance

Any system is only as good as its individual components. The likelihood of downtime is minimised through high quality control and testing standards at our UK manufacturing base. Each individual part goes through a rigorous testing procedure during every stage of assembly, and before shipping and installation, the completed machine will have run continuously for 72 hours or more, at temperatures much higher than the average office. However, like all good things in life, sometime or the other your machine will stop working. Our own nationwide maintenance service can, for a fixed charge provide you with a comprehensive maintenance and 24-hour repair service which includes all parts and labour, and, since we manufacture ACCRON ourselves here in Britain, there is never a delay over waiting for a replacement part.

Stability

NEWTONS Laboratories has been trading (profitably) for more than 7 years. We supply copies of our accounts on request. The computer division specialises in multi-user micro systems, developed and supported by UK based professionals. Its customers include British Telecom, the DHSS, Local Councils, small businesses and large businesses such as BTR and Plessey. NEWTONS Laboratories is involved in continuous research and development.

Dealers and OEM's, Get The Facts

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NEWTONS LABORATORIES

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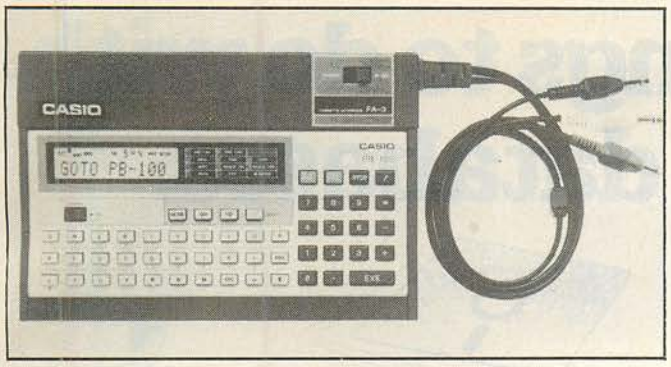
● Circle No. 108



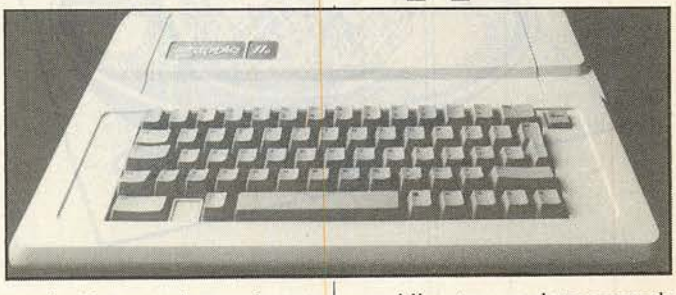
This is the PB-100 pocket computer from Casio. It is designed for the non-specialist in computing. Styled on the existing Casio pocket computers, the PB-100 is aimed at business users, providing them with a number of functions; 10 programs can be stored, with a total of up to 544 program steps. There are 26 memories. Expansion can take the form of extra RAM, allowing 1,568 program steps, or a cassette interface. There will soon be a special printer available as well. The PB-100 comes complete with programming manual and costs £79.95. The RAM option is £13.95, the cassette interface £25.95. Contact Casio Electronics Co Ltd, Unit 6, 1,000 North Circular Road, London NW12 7JD. Telephone: 01-450 9131.

Speedy Basic from Pet compiler

THE PETSPEED Basic compiler is now available for the Commodore 64. It is a special version, optimised for the new micro, from CBM and can transform a relatively slow Basic program into a fast machine-code one. Petspeed comes complete with documentation and is simple to use.

Petspeed costs £125 plus VAT. For details contact Oxford Computer Systems Ltd, Woodstock, Oxford OX7 1JR. Telephone: (0993) 812700. Petspeed is also available from the Commodore dealer network.

New lease of life for Apple II



THE REVAMPED Apple II and products to enhance the Apple III, as well as two new printers, are available now. The Apple IIe takes over from the existing Apple II Europlus and is designed to be software and hardware compatible with it. The main unit, now with 64K RAM as standard and a revised ISO-standard keyboard costs £845.

The Apple II main board has been entirely redesigned with a drastically reduced component count, and weaknesses of the original design have been tidied up. PAL video generation is now on-board and a metal punch-out back is provided to take standard connection sockets to replace the rather insecure old systems of ribbon cables emerging from slots in the back of the machine.

Documentation has been rewritten to make the system as approachable as possible, and has been supplemented by turorials on disc. Apple is providing two cards to upgrade the display to 80 columns, the simpler one costing £80, the other £180, but this also provides 64K of additional RAM. A complete starter system, with 64K Apple IIe, and single 116K floppy-disc drive, 80-column card and monochrome monitor costs £1,199.

Selling boom pleases retailers

MICROCOMPUTERS are now on sale in every High Street. They sold in their thousands in the period leading up to Christmas and look like becoming the most popular electronic consumer item of 1983. For weeks preceding the holiday, tills were bleeping away merrily as proud fathers "invested in their children's futures". Credit cards were flashed and grubby notes exchanged, and the message from the traders is that the home micro made Christmas 82 the most profitable since 1979.

It appears that it took the high-pressure retailing of the large multiple outlets to bring about the microcomputer boom which the industry predicted for a much earlier date. What is now clear is that most retailers did not have the stocks to meet the totally unexpected pre-Christmas demand.

One company to suffer from this problem was Dragon Data, manufacturer of the popular Dragon 32 micro. This is an ironic twist, because the Dragon 32 was the micro in good supply earlier this year when rival machines were scarce. The problem with Dragon grew to such proportions that in the final run-up to Christmas the company had to close its order book.

Tony Clark, managing director of Dragon Data said: "Repeat orders for the Dragon and enquiries from new customers meant that we were in the enviable situation where demand far exceeded supply. Our production capacity was at full stretch and in some cases we would not fulfil orders or guarantee delivery by Christmas."

Although having a full order book has been wonderful news for Dragon Data it has caused its own peculiar problems, according to marketing director, Richard Wadman. Part of the plan to relieve these problems involves moving to a new and larger factory. The other part is a rationalisation of the number of outlets carrying the Dragon.

One of the large chains that carried the Dragon 32 is Currys, the electrical retailer. Currys sells both business systems and its software and home computers and software through a network of 10 specialist Micro-C shops and 37 High Street branches of the Currys chain. This network will eventually extend to the majority of Currys stores as staff are trained. It is what the marketing services manager Linda Burrow calls "uncontrolled expansion".

Currys is firmly committed to providing customers with a high level of support, and for this reason only stocks a limited range of machines. The current list of micros for the home user includes the Commodore Vic-20 and Commodore 64 machines, the Dragon 32, the TI 99/4 and both the Atari machines.

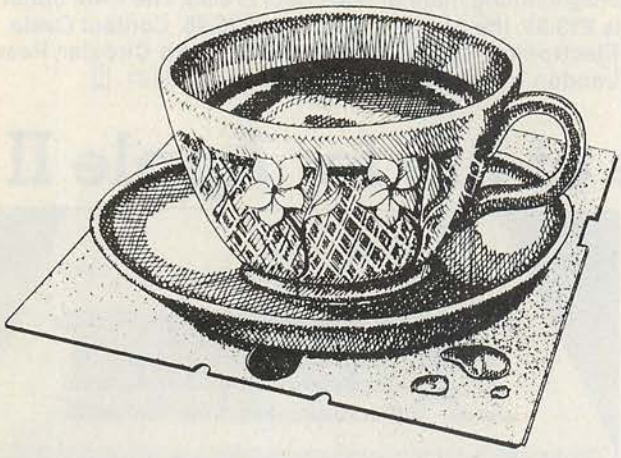
Also in the Currys range but only available at the specialist shops are the Epson HX-20 and the NewBrain computer. Currys looks on them as part of the home-micro range, as opposed to office or small-business machines. The office category starts with the Apple II, which is sold both as a business machine and a games computer. Higher still are the ACT Sirius, the Commodore 8000 range and the Panasonic.

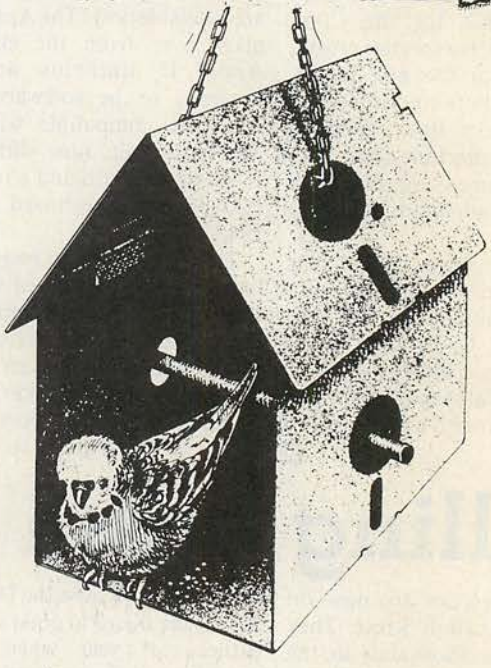
Currys places a lot of emphasis on software. Linda Burrow believes that most people buying a computer buy at least one software package at the same time. More important, most people return to the shop where they bought the machine, to buy the software.

And the future? "The Commodore 64 is going to be a big seller, and we are talking to a couple of other manufacturers right now," says Linda Burrow. "On top of that we have another 15 stores opening computer counters this month."

More news on page 21

Now that Superfile is here: some good things to do with yesterday's databases.





Don't throw those old disks away! An obsolete database could make some budgie very happy. Superfile, the advanced new British database manager, could make you even happier.
Just look at the advantages:

☐ Variable length items – store the data you type in without padding – double your disk capacity.

☐ Search on all items in the database.

☐ Flexible records – add new Fields at any time.

☐ Logically a multi-file database: relational searches easily done via high level language.

☐ Superfile tacks itself onto CP/M and makes the database accessible to programs in any high level language.

☐ Simple-to-use Screen Forms and Report generator packages.

☐ Multi-user – on MP/M, CP/Net, Turbodos, Shelton SIG-NET.

☐ Made in England and widely used by the Government, Hospitals, schools and Universities.

☐ Prices: Superfile £225, Superforms £130, Supertab £130, Mailing List £75.

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KGB Micros Ltd (Superbrain)
Slough, Berks. Tel 0753 38581
Leicester Computer Consultants Ltd (General)
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SUPERFILE

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C/WP CONTOUR is available now for your APPLE II, IBM Personal, Sirius, Superbrain and many other CP/M and S100 machines. On APPLE the C/WP CONTOUR supports DOS 3.3, Pascal and CP/M operating systems.

Write or telephone for full details of this great price breakthrough. Now you can afford the luxury of a Winchester.

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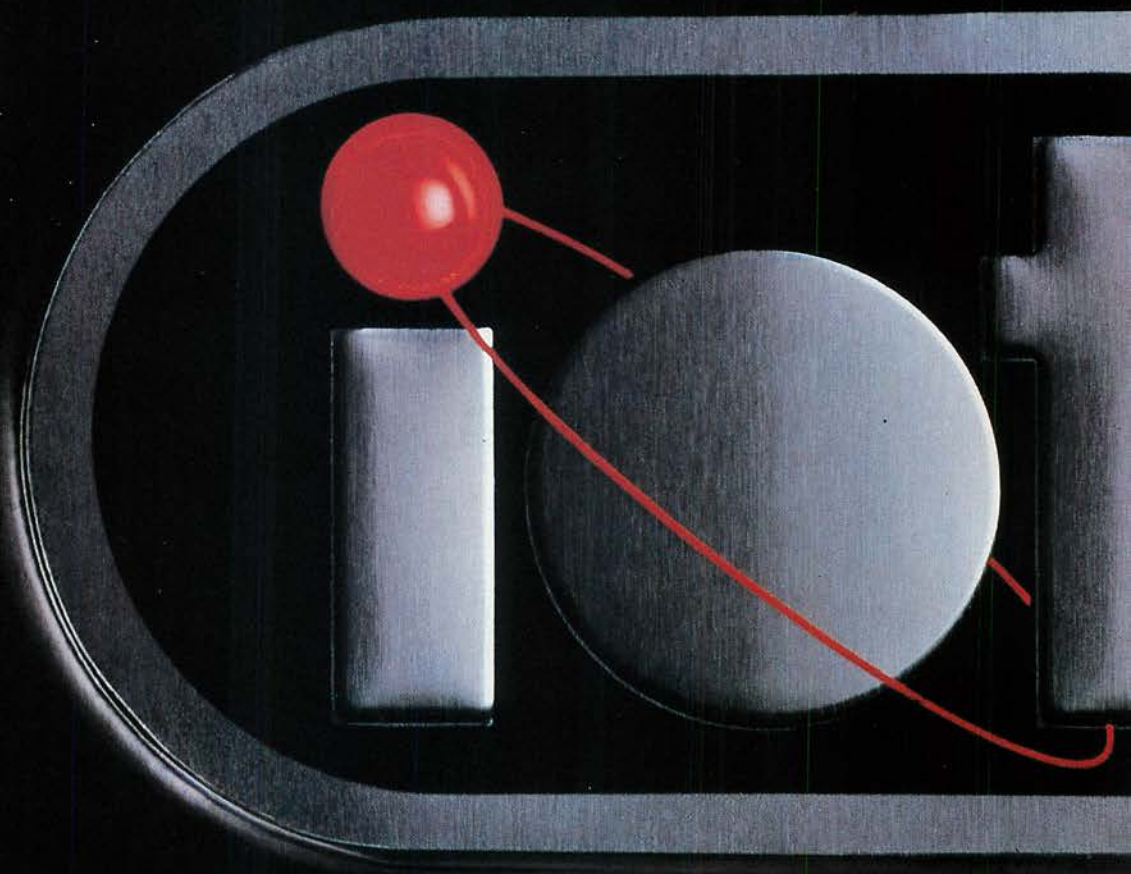

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Iona Computer (75K)
Two 5¼" Disk Drives (400K each formatted)
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★ Industry Standard SASI hard-disk interface
TWO SPARE SLOTS

The cost-effective solution to your computer needs for only £1,495*

For just £1,495 the Galaxy 2 provides the basic requirements for a small business system:

- **Central Processor Unit with 64K of RAM**
- **Twin disk drives (400K storage per drive)**
- **Keyboard and 12" monitor**

But unlike many other small-business systems the Galaxy System is specially designed for expansion and flexibility to meet changing requirements. It uses the world's best selling micro processor, the Z80A, and is based on industry-standard 80-Bus boards. The business system uses only 3 boards in the 5 spaces available, so extra cards can be "plugged-in" to expand the system; for example to expand the memory, or to give a colour facility, or to develop the Galaxy for the particular requirements of education, research, software development etc.

It has a CP/M operating system which gives access to the largest range of software available for any machine. In particular, Gemini can offer QUIBS; a small-business package developed especially for the Galaxy.

The Galaxy has industry-standard interfaces (parallel and serial), and Gemini Microcomputers can supply a full range of compatible hardware including a Winchester sub-system and printer.

The Galaxy offers the most cost-effective way of obtaining a basic unit which is capable of developing to meet your particular requirements; now and tomorrow.

Features include:

- **Twin Z80 Processors**
- **64K Dynamic RAM**
- **800K Disc Based Storage**
- **80 x 25 Screen Format**
- **Dual Printer Interfaces**
- **Modular Design**
- **Extra Disc Drives Easily Added**
- **Winchester Expansion Available**
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- **Additional Slots for 2 Cards**
- **12" Green or Amber Monitor**

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● Circle No. 11

Provincial shows pull in crowds

WITH AN ATTENDANCE of 23,073 visitors in only three days the Northern Computer Fair was an unqualified success. Held at Belle Vue, Manchester, the exhibition attracted not only a large number of home-computing enthusiasts but also a substantial body of professional and business people with a strong practical interest in personal computers.

This interest was particularly evident on the stands featuring the ACT Sirius 16-bit microcomputer which included those of Raven Computers, MCP Microsystems and The Micro House — all specialists in small business systems based in the north of England.

Other stands which attracted the crowds included Dragon Data, whose Dragon 32 must have been one of the best-selling home computers at the show; and Camputers, which was introducing the 48K Lynx at a price of only £225.

Following the success of the Northern Computer Fair, the third in this nationwide series of exhibitions will be held in Birmingham from April 28-30. This event, the Midland Computer Fair, will take place at Bingley Hall in the centre of Birmingham and it is expected that it will attract visitors in similar numbers to the Manchester show. Companies wishing to obtain further information about this exhibition should contact the Exhibition Manager, The Midland Computer Fair, IPC Exhibitions Ltd, Surrey House, Throwley Way, Sutton, Surrey SM1 4QQ or telephone Roy Bratt on 01-643 4859.

Perfect Writer

ON PAGE 103 of the February issue we reviewed Perfect Writer from Perfect Software. If you would like further details the address is Perfect Software, 1,400 Shattuck Avenue, Berkeley, California, Ca 94709. Perfect's products are distributed by Micro MarketingInternational, 1,598 Taft Ave, Oakland, Ca 94618. Please mention *Practical Computing* if you are contacting them.

Apple, DEC and IBM set to compete for executive market

FOR THE FIRST time the giants of the computer field are to meet head-on — in the professional personal-computer market. The significance of the plans revealed by IBM, DEC and Apple are that each at present holds the dominant share in respectively the mainframe, minicomputer and microcomputer fields. And each is adopting a different strategy in an attempt to take the personal computer prize.

The IBM PC is to be available immediately in the U.K. through official IBM channels. Full details on the micro itself and associated new products appear on page 35 of this issue. Support is to be available on a standard 24-hour turn-round basis to clients who bring the problem machine in to IBM service centres, four of which are being set up immediately.

DEC has announced dealers, software and support arrangements for the Rainbow 100, Decmate II and Professional range of computers. Volume sales commence in March, although a few machines might have come in earlier. The support arrangements are considerably in advance of those usually provided by hardware manufacturers at the personal computer end of the market.

Free for the first 12 months and probably for around seven percent of the system price per annum subsequently is on-site hardware maintenance. During the working week an eight-hour turn-out is guaranteed. To fix less serious faults and software problems more quickly DEC has set up a 35-person unit to give 24-hour telephone cover. Details of the hardware and software configuration sold to all DEC users will be held on a multi-terminal DEC computer system at the Basingstoke location of the unit.

The IBM PC should sell on the IBM name, despite its price.

DEC offers the Rainbow 100, Decmate II and Professional.

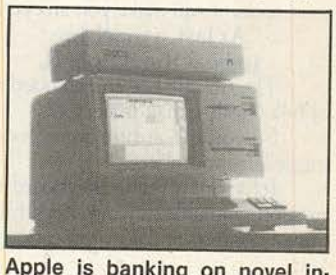
Prices, with on-site service for 12 months included, are £2,360 for the Rainbow 100, £2,528 for the word-processing oriented Decmate II, and £3,348 for the Professional 350. The Rainbow 100 is the most direct challenge to established microcomputer vendors, and for the price quoted comes with twin 400K floppy-disc drives, 64K of RAM, keyboard and monochrome display. With two processors — a Z-80 and an 8088 — it can run either eight-bit CP/M or 16-bit CP/M-86 software under its CP/M-86/80 operating system. MS-DOS is available as an option.

DEC has produced the first addition of its quarterly Classified Software Catalogue. It includes all the well-known names of the microcomputer software world such as Peachtree, Graffcom, Visicorp, Micropro, Compsoft and Microfocus. Some less well-known DEC specialists also appear, including Intelligence (Ireland) Ltd., which specialises in communications and terminal emulation software.

The catalogue is particularly strong on the system software side, with languages like C, Mumps, RTL/2 and several versions of Cobol available. The more unusual offerings in microcomputer terms are generally for the PDP-11 compatible Professional 325 and 350 machines.

The DEC software scheme is very tightly controlled. Once software is accepted for sale through the DEC distribution chain, DEC takes over the actual process of copying it on to disc, and print the paper documentation to ensure consistency of quality. DEC supports the package via its telephone support service, free of charge for the first year.

Apple is defending its stronghold in the personal-computer market with extensions to the existing Apple II and Apple III product ranges, and by the introduction of the Apple Lisa. The Lisa was announced in January and will be available in the U.K. and Europe in the summer. It is previewed on page 77 of this issue.



Apple is banking on novel integrated software for its Lisa.

There is no operating system visible to the user in the conventional way, and no operating-system commands to remember and type in. Instead the mouse, a hand-held pointing device, is used to select options and control events on a detailed graphic representation of a desk top.

(continued on page 23)

From Apple, The Inventors Of The Personal Computer.

EVOLUTION.

Since Apple brought the power of computing to the desk tops of ordinary people with the Apple II, the world hasn't been the same.

Neither has Apple.

We've been refining and improving the way our machines work, to improve the way you do.

So if an Apple was always designed to make you a better businessman, today it will make you an even better one. And faster too.

At last, a machine to beat the Apple II.

The new IIe has an extended memory of 64k (easily expandable, too).

So you can create fatter files and juggle larger numbers.

It has a new, refined keyboard with user-programable function keys, full cursor controls and auto-repeat on every key.

The IIe also features improved peripheral ports, 16-colour graphics and access to the biggest library of software in the world.

Apple III. Pound for pound the most powerful you can buy.

The Apple III now has a standard memory of 256k.

Apple III also has its own personal mass storage system called Profile and a vast selection of business software that takes advantage of the extensive capacity Profile offers.

Apple LISA: Give it 20 minutes and it will change your life.

With LISA, Apple comes full circle to yet another computer revolution. LISA is a personal office system that works by representing the visual symbols of your desk on its screen.

Files look like files. A calculator looks like a calculator. You simply point to what you need with a desk-top device called a "mouse."

If you want to print something, you just point to the printer.

LISA is so simple and easy to use people with no experience of computers will be happily using one in 20 minutes.

There are already 600,000 Apples making people and their businesses more efficient and profitable around the world. With the IIe, III and LISA, there are going to be a lot more.

Because now there's an Apple for everybody. And everybody should have a friend like Apple.

The personal computer. apple

Please send me further information on Apple Personal Systems. Tick appropriate box below. Apple Computer (UK) Limited, Eastman Way, Hemel Hempstead, Herts. HP2 4BR. FREEPOST. Tel: 0442 60244

☐ IIe. The Personal Professional Computer.
☐ III. The Personal Business System.
☐ LISA. The Personal Office System.

Name

Company/Address

Tel. No: PC1

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REVOLUTION.

● Circle No. 11

(continued from page 21)

The same approach has been used successfully on the up-market Xerox Star executive work station and the ICL Perq CAD work station. The Lisa is aimed firmly at the office sector, where Apple is looking for substantial fleet sales, and is the top of the Apple range. It costs $12,000, which might translate to around £8,000.

To enhance the existing Apple III business-oriented micro there are two new disc units: the 820K Unifile costs £650, and the 1.7K Duofile is priced at £1,100. Both are based around the new Apple-manufactured Twiggie 5.25in. floppy drive, also used in the Lisa.

The new drive uses slightly non-standard floppy discs, with two read-write holes cut in the plastic outer envelope on each side of the disc instead of the usual one. Apple says this dramatically improves the reliability of the double-sided floppy, as the read-write heads are not pressing against each other from opposite sides of the disc, which can distort the flexible recording surface as it rotates between them. Media costs are around $10 a disc at the moment, higher than conventional discs, but with Verbatim and 3M manufacturing Twiggie-style floppy discs prices may reasonably be expected to fall as volume builds up.

Apple is also now selling printers, which allows the firm to offer customers a complete system with the Apple name on every component for the first time. The dot-matrix printer costs £450, has a 10in.-wide platen, a 3K print buffer, six different character sets loaded up in ROM, and prints at 120cps using a nine-by-seven dot matrix.

The daisywheel printer costs £1,200, has a 15in. platen and prints bidirectionally with letter quality at 40cps. Both printers use industry-standard interfaces and so can be used with non-Apple equipment.

Personal computers are the most rapidly growing sector of the whole computer market. According to DEC U.K. managing director Darryl Barbe, in excess of $1 billion has been spent so far on the DEC personal computer project.

Apple, a smaller and newer company, with turnover now just reaching $1,000,000,000 a year, has made a proportionately greater investment with the Lisa, putting all its chips on the table, according to Apple Chairman Steven Jobs. Software development alone for Lisa absorbed two person centuries of effort. "We are willing to bank the company on this," comments Jobs.

With this full commitment by such heavyweight companies it must be obvious to the most cautious potential user that personal computers are no longer untested things suitable only for the intrepid. In consequence, fleet sales to large companies are expected to account for a growing proportion of sales.

IBM has many of the top Times 100 and Fortune 500 companies on its books already as mainframe customers. DEC is probably in there somewhere too, supplying minicomputers or board-level products to some part of the organisation. Apple is, relatively speaking, the outsider. Plenty of Apple IIs are in use in large companies, it is true, but since the unit cost is so much lower it may not have been forced to develop such good contacts at the higher levels of the decision-making hierarchy.

The greatest strength in this type of selling lies with IBM, which does not really have to do much more than add a credible personal computer product to its range to sell heavily to its existing customer base. DEC is offering very good support arrangements, which are likely to make its personal computers appeal to people who have not used computers before and who really want as many sources of worry removed as possible. Apple is putting its faith in innovation, sinking a heavy investment into making the Lisa office system as easy to use as the state of the art allows.

Apple Computer U.K. Ltd., Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244; DEC, Marketing Communications Dept. P.O. Box 110, Reading, Berkshire RG2 OTR; or telephone the new DEC Customer Information Centre on Basingstoke (0256) 59200; IBM United Kingdom Product Sales Ltd, P.O. Box 32, Alencon Link, Basingstoke, Hampshire RG21 1EJ; telephone (0256) 56144.

More news on page 24

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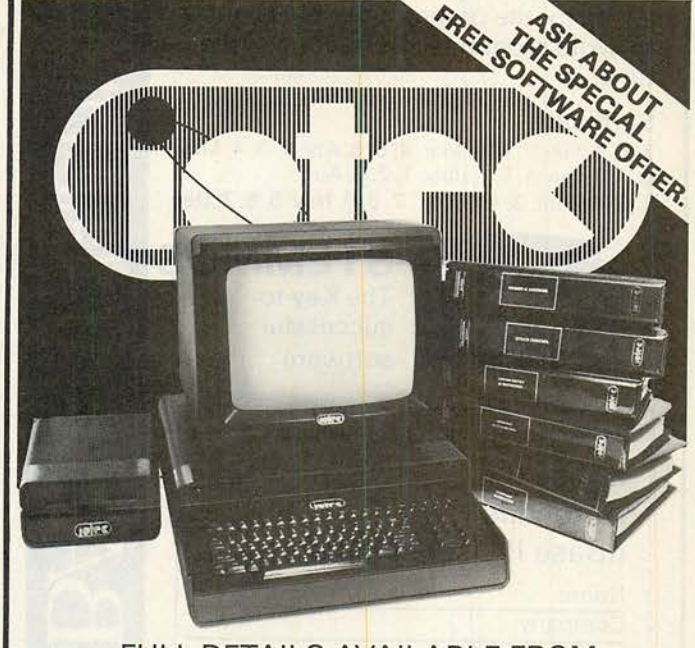

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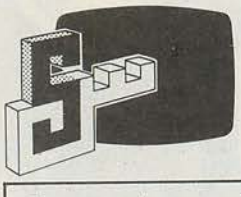

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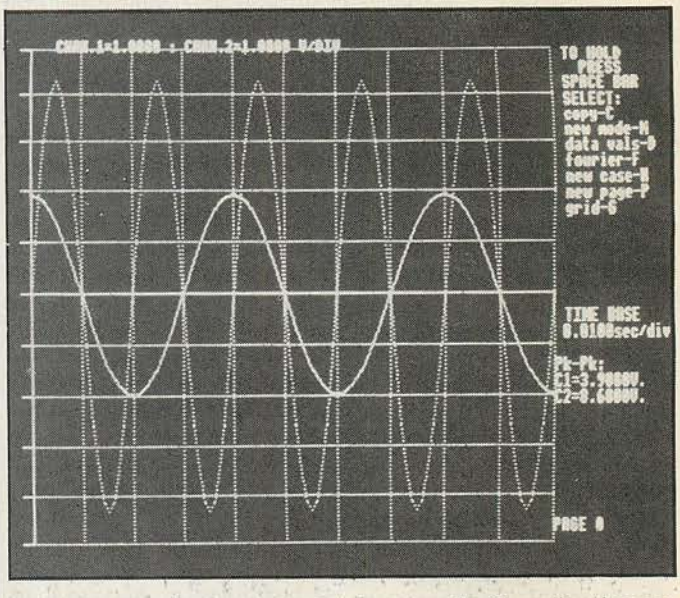
BBC Micro becomes a two-channel 'scope



THE GSL ANALOGUE SIGNAL display and analysis system will turn a BBC model B computer into a large-screen storage oscilloscope. It has a two-channel input and can accept frequencies up to the high audio range. It also has a printer.

A fixed number of screens can be stored in memory and can be recalled for subsequent comparison. The two input channels can be triggered automatically or externally. Sampling time can be varied from 0.002 to 25 seconds. The system uses the computer's high-resolution graphics with 250 by 500 pixels.

The system costs £1,206.35 for a monochrome system and £1,407.60 for the colour system, both prices including VAT. For further details contact GSL, 2 North Way, Andover, Hampshire SP10 5AZ. Telephone (0264) 58744.

Midwich games joysticks

THE MIDWICH JOYSTICKS have a life expectancy of more than 200,000 operations. Made of injection-moulded plastic and designed to sit comfortably in the hand they are available for the Dragon 32, BBC Micro, ZX-81 and ZX-Spectrum.

A push-button switch is incorporated in the handle, which may be used as a fire-button. Each joystick or pair of sticks comes supplied with the appropriate connector for the machine in question, and in the case of the ZX-81 and Spectrum there is a four-channel joystick port. Prices are: Dragon 32, £15.98; BBC, £13.00; ZX-81/Spectrum, £15.98. The controller board costs £22.95.

Midwich Computer Company, Rickinghall House, Hilderclay Road, Rickinghall, Suffolk IP22 1HH. Telephone: (0379) 898751.

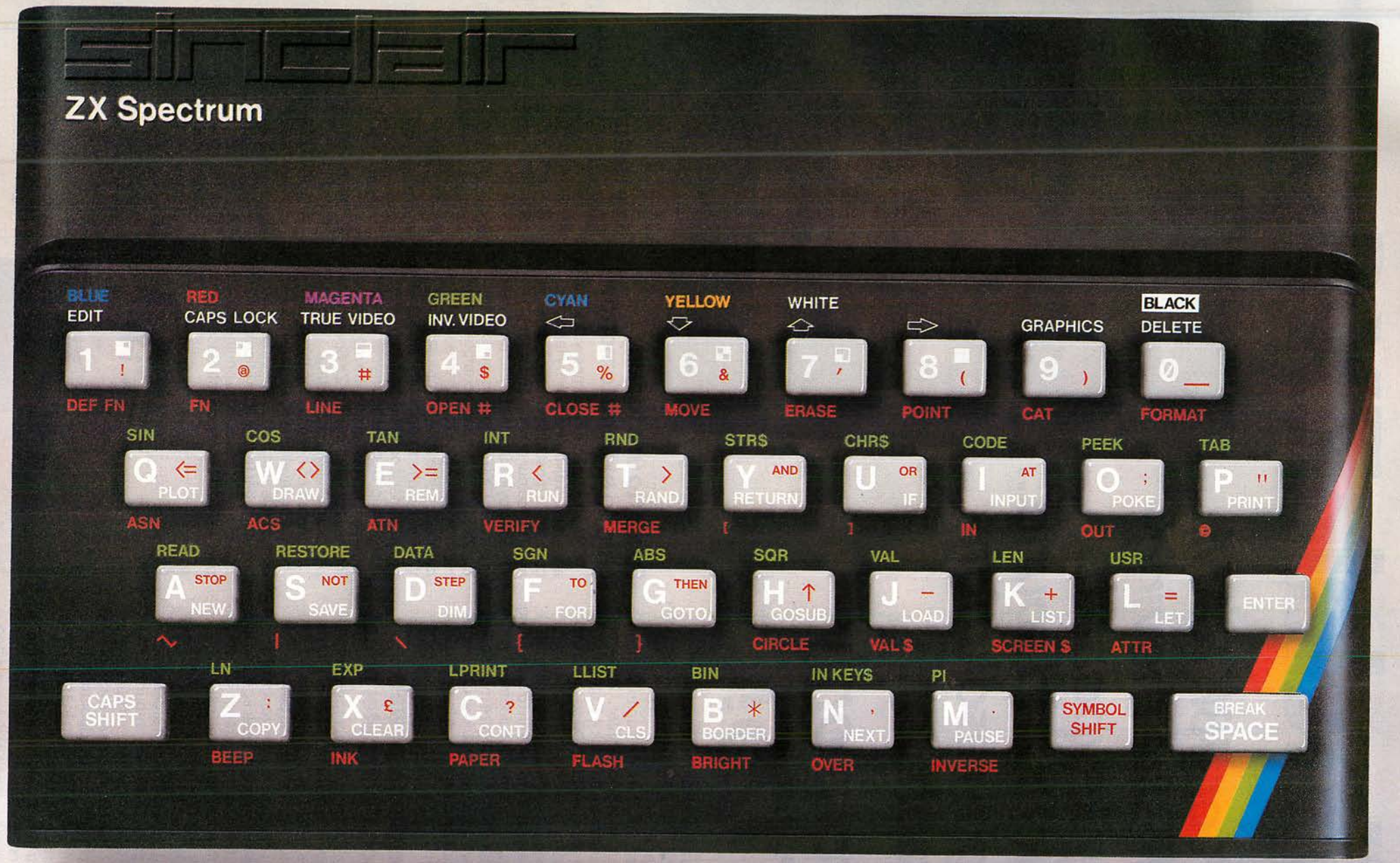
Electrical modeller

AC/MP IS AN ELECTRICAL circuit-modelling CAD package which will run on a CP/M system. Capable of modelling any AC circuit with up to 24 nodes, the package solves the simultaneous linear equations that are usually associated with electrical circuit design.

There are file, file-editing and plotting capabilities. Functions include Gain, both linear and in dB, Phase, ZIn and ZOut for input and output impedences, and Bandwidth. A normal printer can be employed to print frequency-response curves, which are log-log scaled.

AC/MP is available from Harcourt systems, 9a Keswick Road, Orpington, Kent BR6 OEU. Telephone: Orpington 26469.

More news on page 29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ZX Spectrum
BLUE EDIT
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MAGENTA TRUE VIDEO
GREEN INV. VIDEO
CYAN
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WHITE
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BLACK DELETE
1 ! DEF FN
2 @ FN
3 # LINE
4 $ OPEN #
5 % CLOSE #
6 & MOVE
7 ' ERASE
8 (POINT
9) CAT
0 _ FORMAT
SIN COS TAN INT RND STR$ CHR$ CODE PEEK TAB
Q PLOT ASN
W DRAW ACS
E REM ATN
R RUN VERIFY
T RAND MERGE
Y AND RETURN
U OR IF
I AT INPUT
O ; POKE OUT
P " PRINT
READ RESTORE DATA SGN ABS SQR VAL LEN USR
A STOP NEW
S NOT SAVE
D STEP DIM
F TO FOR
G THEN GOTO
H GOSUB CIRCLE
J LOAD VAL $
K LIST SCREEN $
L LET ATTR
ENTER
LN EXP LPRINT LLIST BIN IN KEY$ PI
CAPS SHIFT
Z COPY BEEP
X CLEAR INK
C CONT PAPER
V CLS FLASH
B BORDER BRIGHT
N NEXT OVER
M PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Spect

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power–personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

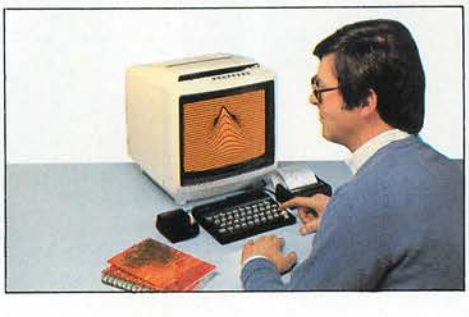
You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and borde plus flashing and brightness-intens control.
- Sound – BEEP command with varia pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – al keys at normal typewriter pitch, wi repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true hi resolution graphics.
- ASCII character set – with upper- a lower-case characters.
- Teletext-compatible – user softwar can generate 40 characters per lin or other settings.
- High speed LOAD & SAVE – 16K in seconds via cassette, with VERIFY MERGE for programs and separat data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

Spectrum software on settes – available now

e Spectrum software library is g every day. Subjects include , education, and business/ nold management. Flight tion...Chess...Planetoids... ...Inventions...VU-CALC...VU-3D Record Controller...there is ning for everyone. And they all ull use of the Spectrum's colour, and graphics capabilities. You'll e a detailed catalogue with your um.

xpansion Module

s module incorporates the three ns of Microdrive controller, local twork, and RS232 interface. ct it to your Spectrum and you can up to eight Microdrives, unicate with other computers, and wide range of printers. e potential is enormous, and the will be available in the early part for around £30.

inclair

r Research Ltd, Stanhope Road, rley, Surrey GU15 3PS. mberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

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PRC 903

FREEPOST – no stamp needed. **Prices apply to UK only.** **Export prices on application.**

Sinclair ZX Spectrum–technical data.

Dimensions

Width	233 mm
Depth	144 mm
Height	30 mm

CPU/ memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.

16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics

Point, line, circle and arc drawing commands in high-resolution graphics.

16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive–or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions

Arithmetic operations of +, –, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.

Numbers are stored as five bytes of floating point binary – giving a range of $+3\times10^{-39}$ to $+7\times10^{38}$ accurate to $9\frac{1}{2}$ decimal digits.

Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String operations and functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.

A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names

Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface

The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.

IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.

Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.

ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY.

ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

sinclair

ZX Spectrum

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 685311.

● Circle No. 117

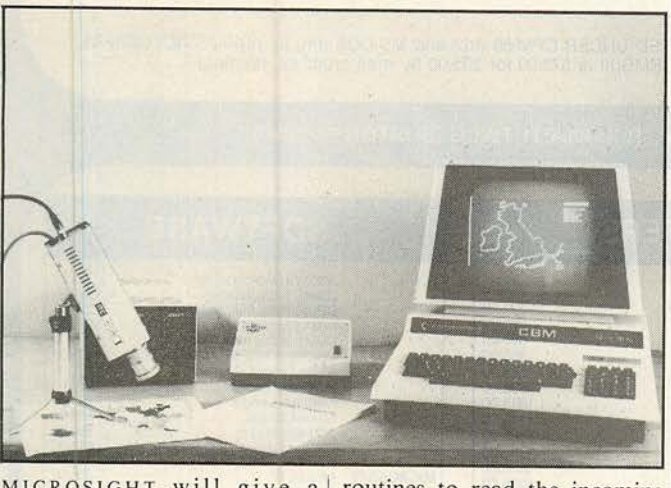
Portable Forth

HAVE YOU EVER spent a lonely evening in a hotel room wishing you could get on with that relational database you were writing in Forth? No, we haven't either, but if you do miss programming in Forth as you travel the world, Kuma Computers has developed a version of Forth for the Osborne portable micro.

Kuma Fig Forth runs under CP/M and conforms to the Fig Forth international standard. It includes a number of features such as a screen editor and a full Z-80 assembler, which should make life easy for the Forth programmer. The most interesting feature is that it uses CP/M files for all operations.

There is a comprehensive manual, with a tutorial for newcomers to the language, as well as some demonstration listings. Kuma Fig Forth costs £85 and is available from Kuma Computers Ltd, 11 York Road, Maidenhead, Berkshire. Telephone: (0628) 71778.

Camera-to-computer graphics interface



MICROSIGHT will give a microcomputer eyes for less than £500. The system comprises a standard CCTV camera, a camera-computer interface and vision software. The Microeye camera-computer interface sends images to the computer as eight-bit digital video.

System software includes a set of processor and disc-handling routines, plus six machine-code routines to read the incoming data and process it for high-resolution display. Images can be stored in RAM, while analysis can be carried out to determine features such as length, width, perimeter and centre of gravity.

Microsight comes with full documentation and costs £495 plus VAT. For information contact Digithurst Ltd. Telephone: (0223) 208926.

Tandy's 16-bit micro

TANDY IS TO OPT FOR the Zenix multi-user operating system on the new TRS-80 model 16 microcomputer. The micro is based on the Motorola 68000 processor, which lends itself readily to Zenix, a Unix-like operating system. The micro also has a second Z80-A processor to handle housekeeping tasks.

The new micro is upgradable from the Tandy model II via a special kit. It can handle up to three terminals simultaneously running different applications. The memory capacity is expandable from the initial 128K to 512K.

The single-user model 16 is able to run model II software on a more powerful machine and costs £3,599 including VAT for a single-drive machine. The minimum multi-user system requires an additional 128K RAM and a hard-disc unit. The machines will be available through the nationwide Tandy dealer network.

FULL DETAILS AVAILABLE FROM

Gem Systems Ltd
2 Crawford Road
Hatfield
Tel No: 30-64137/66148

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MicroSight

MicroSight 2 (CID)	£2990+Vat
MicroSight 1 (CCTV)	£499+Vat
Vision Interfaces from	£99+Vat

For details contact:-

DIGITHURST

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20 main/200 sub fields per record
field and record related formulae
'Jump-to' any of 32000 records per file
random/binary/key/multiple field search
'if-then' questioning
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speed of 500 records per 20 seconds
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12 online file architectures
240 fields using cross-referencing
cross-record calculations
'Jump-to' any record in 12 files
User-defineable files/field words/sizes
endless 'either-or' matching
formulate/recall on selection criteria
12 interrogation question types
short filing output/audit trails

ONE OF THOUSANDS OF DIFFERENT TASKS ON WHICH THIS PROGRAM MIGHT BE EMPLOYED

DMS'S MACROS WORK FROM THE MOMENT YOU INSERT THE 'TASK DISK' IN THE COMPUTER DRIVE

Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulate any task you wish the program to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "sale-mail-shots"; "production-process-analysis"; "patient history analysis"; "research-analysis"; "budgetting" "purchase/sales-analysis"; "personell-file-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

Previous issues showed examples of 'employees-short-list', 'garage stock re-order', 'sales analysis' 'librarian's list' 'hospital's patient list' here is an example of a 'rental recording file' and some reports it might generate.

The record may look like this:
1-record number (413)
2-client (Radio cars ltd)
3-date of contract (01.04.81)
4-date last pmt (12.02.82)
5-period/frequency (36 / monthly)
7-amount of pmt (22.50)
8-item type (Taxi-phones)
9-repairs made (faulty microphone — item replaced)
10 cross reference (3.422!C details of full system spec and supplier)

One report might be: select ?? all records where the amount of payments are less than 50 pounds, that were taxi-phones and faults were detected. When found, pick up the cross reference code and look up that record to identify the supplier.

Another report might be: select ?? all records in the file where the commencing date of rental was 04.81 and the term was greater than 12 months. Print a list of all those records where the date last payment was prior to (ie smaller than) 03.82 and prepare a short address file for 'reminders'.

DBMS II (WITHOUT MACROS) AND DBMS III ARE FULLY IMPLEMENTED UNDER CPM-86 (tm) and MS-DOS (tm) ie: (SIRIUS/VICTOR/IBM)
DBMS II IS 395.00 (or 250.00 by mail order ex. training). DBMS III is 575.00 (or 295.00 by mail order ex. training)

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	-Superbrain 64K RAM/1.5M disks	2595.00
	-Superbrain 64K RAM/10M disks	call
	-Compustar 64K RAM/0K disks	1495.00
	-Compustar 64K RAM/320K disks	1995.00
	-Compustar 64K RAM/700K disks	2495.00
	-Compustar 64K RAM/1.5M disks	2895.00
NORTHSTAR	-Advantage 64K RAM/700K disks	£2095.00
	-Advantage 64K RAM/5.3M disks	£2995.00
	-Horizon 64K RAM/6.3M disks	3595.00
TELEVIDEO	-802 64K RAM/700K disks	1995.00
	-802H 64K RAM/7.3M disks	3250.00
	-806 64K RAM/10M disks	4595.00
	-816 256K/750K disks	£2950.00
ACT	-Sirius 1 128K/1.2M disks	£2395.00
	-Sirius 2 128K/2.4M disks	£2895.00
VICTOR	-9000 128K/1.2M disks	£2395.00
OSBORNE	-1 64K RAM/200K disks	1250.00
IBM	-PC 64K RAM/640K disks	£2695.00
	-PC1 330K/640K disks	£2995.00
PET	8032 32K RAM	795.00
	8050 1 Meg disks	795.00
	64 CBM personal computer	call
APPLE	II 64K/CPM/2 disk/Monitor	2395.00
ALTOS	ACS800-2 64K RAM/1M disks	1995.00
	ACS800-10 208K/10.5Meg disks	5495.00
NEC	PC8001/12 64K RAM/350K disks	1695.00
	APC 128K RAM/2M disks	call
CORVUS	Concept 16 bit pc	call
SANYO	G80 64K RAM/320K disks	1350.00
ABC	24 64K RAM/700K disks	2195.00
	26 64K RAM/2.2M disks	3250.00

All computer prices include mbasic as standard.
All prices marked £ are 8/16 bit machines.

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DBMS II	magic wand w/proc	magic calc
mbasic 80	diagnostics	msort/dsort
recover	autoload	instant basic
cbasic	disk/games	library case

****total value 1525.00****

If the system value exceeds 4000.00 then you get the G80/86 software packages value 690.00 also
THAT'S OVER 2000.00 POUNDS WORTH OF SOFTWARE FREE

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	-Microline 82A	395.00
	-Microline 83	695.00
	-Microline 84	895.00
EPSON	-MX80/FT-3	395.00
	-MX100/FT-3	525.00
ANADEX	-DP 9000	895.00
	-DP 9501	1045.00
	-DP 9501 (A)	1145.00
QUME	-9/45 R/O	1695.00
	-9/55 R/O	1795.00
	-9/35 R/O	1495.00
NEC	-3510 R/O	1395.00
	-7710 R/O	1795.00
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TEXAS	-810	1195.00
	-825	1095.00
DIABLO	-630	1695.00
RICOH	-RP1600	1495.00
OLYMPIA	-ESW 103 14 CPS	975.00
	-ESW ??? 55 CPS	1025.00

PERIPHERALS & ACCESSORIES

CORVUS	-6 Meg hard disk	1750.00
	-11 Meg hard disk	2750.00
	-20 Meg hard disk	3750.00
	-Multiplexor 7 station	695.00
	-Mirror backup card	695.00
INTERTEC	-Compustar 10 Meg hard disk	2750.00
	-CDC 96 Meg hard disk	7950.00
N'STAR	-16 Bit u/grade	325.00
	-18 Meg hard disk	2995.00
RODIME	-6 Meg hard disk	1495.00
	-12 Meg hard disk	1950.00
MORROW	-26 Meg hard disk	3295.00
GENIE	-5MG fixed/5MG removeable disk	3295.00
CDC	-s/sided floppy drives	150.00
	-d/sided floppy drives	225.00
	-d/sided d/track drives	375.00
MEMOREX	-soft/hard s/sided diskettes (10)	30.00
SCOTCH	-104/2D double sided (10)	50.00
S.S.E.	-Softbox PET to CPM (tm)	495.00
	-Sirius 8/16 bit 5MHz card	365.00
QUADRAM	-64K print spooler/copier	250.00
BIZCOMP	-RS232/auto-modem 1200 baud	450.00
AST	-Port expanders (4 tmnls to 1 prtr)	395.00
GIX	-Port expander (switches)	95.00
GIX	Port expander (switcher)	95.00

NOTE: Corvus drives with multiplexor may network sirius . . Superbrain . . Concept . . PET . . Victor . . IBM

SOFTWARE

G.W.L.	-BUS V8.00 (Accounts)	275.00
	-DBMS II (Database)	£395.00
	-DBMS II (by mail order only)	£250.00
	-DBMS III (database)	£575.00
	-DBMS III (by mail order only)	£295.00
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	-Sales Ledger	£95.00
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	-Nominal Ledger	£95.00
	-Stock-Control	£95.00
	-Address-Mailer	£95.00
	-QASort/QNSort (500 Recs/14secs)	£95.00
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	-Fortran 80	295.00
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DIGITAL	-Despool	30.00
	-CBasic	75.00
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N'West	-Statpak	250.00
OASIS	-The Word	35.00
ITHACA	-Pascal Z	100.00
MICROSTUFF	-Cross-talk (Tele-comms')	95.00
WOOLFE	-Move-it (Micro to Micro)	45.00

Software formats on all micros in our hardware list.
All prices marked £ are available 8/16 bit formats.

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The invoicer (95 pounds) * *
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Based upon one hard disk and multiplexor module the G80/86 networks feature full network sharing of data resources by adding different stations that may be as various as Sirius/Victor 9000/IBMSuperbrain/Pet/N' star/Sanyo. The low-cost start-up of a network could be simply

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The PC launched in Britain — official

Already here in numbers as a "grey" import, the IBM PC is now available with official back-up.

ON JANUARY 18 IBM finally launched its Personal Computer in the U.K. nearly 18 months after its American introduction. Of course the IBM PC had been available in the U.K. for some time but only as a "grey" import, not with the blessing of the company itself.

The new machine does not show any remarkable advances over its American cousins. The keyboard has been specified for the U.K. The drives are now 320K. The minimum RAM is now 64K instead of 16K — IBM provided a cassette-based 16K model for the home-market in America. The PC no longer needs a mains transformer to be added. All these were expected and delivered: anything more radical, such as replacing the 8088 chip with an 8086, has not.

Possibly the most original part of the launch is that IBM has formed a new subsidiary, IBM United Kingdom Product Sales Ltd, to market the new machine. Outlets will be authorised dealers and IBM Retail Centres, with bulk purchases or "fleet sales" being handled direct.

Many people had wondered how IBM was going to sell what is, by IBM standards, a low-priced computer. The new sales company indicates that it will be looking for high turnover.

However, in U.K. terms the IBM PC is not exactly cheap. The retail price of the minimum self-sufficient system, with 64K of RAM and only one 160K floppy disc, is £2,080 plus VAT. A proper business system with 128K of RAM and two 320K drives, plus printer, is priced at £3,442 plus VAT. As the printer is only an Epson MX-80 wearing an IBM badge, not a letter-quality printer, this is not going to give too many rival suppliers sleepless nights.

The IBM PC broke new ground when it was launched in the U.S., just as the Sirius 1 did in the U.K. A year or so later, however, there are many micros on offer with superior performance at a similar, or even a lower price.

Most of the major computer manufacturers have now entered the micro market. DEC and Wang have produced excellent micros, and Data General has virtually halved the price of its Enterprise 16-bit machine. The Sirius is by now well established.

IBM will undoubtedly do well with the PC, but is unlikely to sweep the market in quite the way achieved in the U.S.

Initially, however, there will be many major companies who want the IBM machine. They will be buying in bulk, and able to negotiate a discount. Anyway, they may have IBM mainframes or minis and not be too bothered about the price. These buyers will probably absorb all the spare machines IBM can supply until the company starts manufacturing at Greenock in Scotland later this year. When you have people clamouring to buy micros and they are in short supply, why reduce the price?

At least this will give the "plug compatible" manufacturers — of which there are now many — a chance to build their market share. For whether the IBM PC is a huge success, or just a success, it is certainly going to set a standard. It will generate massive amounts of software and, as continuing sales of the Apple II demonstrate, software sells hardware. If it does not sell IBM hardware, then the plug-compatible rivals will benefit.

Digital Research's offering

DIGITAL RESEARCH may not have written PC-DOS, but it has produced a range of products to run on the IBM PC. First is Digital's own DOS, CP/M-86, to rival Micro-Soft's. To encourage people to use it, Digital has priced it at only £42 — about one-quarter of the cost of the IBM version.

In addition, CP/M-86 incorporates some enhancements. They include a print spooler, to allow background printing while the micro is used for something else, GSX extensions for use with graphics packages and a library of device drivers for use with various popular printers.

A multi-tasking version of the famous operating system, called Concurrent CP/M-86, will also be available, plus a range of programming languages such as CBasic, CBasic Compiler, Pascal MT+, Cis Cobol, and PL/1.

Concurrent CP/M-86 can be bought separately or as part of the PC Power Pack. This includes a Percom Data 5.25in. Winchester hard disc, a 256K RAM board and controller.

Finally, Digital Research has announced Logo for the IBM PC. It will be able to use the whole of RAM, giving up to 100,000 workspace nodes.

Contact Digital Research (U.K.) Ltd, Oxford House, Oxford Street, Newbury, Berkshire RG13 1JB. Telephone: (0635) 35304.

MicroSoft's Multiplan spreadsheet is proving to be one of the most popular of its type. It is already available for the Apple II, Wang PC, Olivetti MS-20 and Victor 9000 micros, among others. Now it has been produced for the IBM PC and customised for the IBM keyboard. An excellent extra feature is the ability to "paint" in colour to produce blocks or windows of information. Contact Microsoft Europe Ltd. Telephone: (04427) 75091.

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VIC and 64 users

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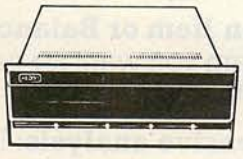

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Axioms and assumptions

Boris Allan discusses different approaches to the logical processes of argument.

WHEN EXAMINING any argument for its validity Aristotle suggested that there are two key aspects to be studied. The first aspect is what we now call deductive logic — the process by which we move from our assumptions to our conclusions. Aristotle was concerned to find valid processes of argument by what he termed apodeitic logic.

The other aspect is what we might now call inductive logic — the nature and status of our assumptions. He was concerned to find valid bases for argument by discerning the essences of things.

Aristotle realised that each initial condition is itself a result of earlier conditions. Why is the initial condition an initial condition? On page 175 of *Aristotle,* H B Veatch explains: "at each stage of the explanation the why-question recurs, and apparently so as never to receive a final answer."

Aristotle's method

In mathematics and those subjects considered to be mathematically inclined the Aristotelean distinction between induction and deduction has been codified into what is termed the axiomatic method. In mathematics an assumption is called an axiom, defined in the *Oxford Dictionary* as "a self-evident proposition, requiring no formal demonstration to prove its truth but received and assented to as soon as mentioned." The axiomatic method derives its power from the possibility of deriving many results from a few assumptions, the axioms. The classic example is that of Euclidean geometry — see *Mathematics in western culture,* chapter 4.

In contemporary mathematics a proof consists of showing how a conclusion follows from the assumptions. If a conclusion does follow from the axioms then it is often termed a theorem of the system. Suppose you had the assertion that

$$(A + B)^2 = A^2 + 2AB + B^2$$

To prove it is true one has to make certain assertions and by use of accepted rules of derivation produce the above result. *Concepts of modern mathematics,* pages 76 and 77 makes eight assertions. You prove one assertion, the theorem, by use of other assertions, the axioms. The first axiom to be listed by *Concepts of modern mathematics* is

$$(A + B) + C = A + (B + C)$$

This is not a self-evident truth, it is the associative law of addition and has to be shown to be true — that is, it is treated not as an axiom but as a theorem.

The associative law might seem to be self-evidently true since

$$(3 + 4) + 5 = 3 + (4 + 5) = 12$$

But why should it be true for numbers other than 3, 4 and 5? And even if it were true for all numbers why is it true for A, B and C? We are back to Aristotle's distinction: ultimately you cannot justify your axioms unless you "know" that something is true.

How would you define the meaning of 1? It is impossible to define 1 in terms which do not presuppose other numbers, yet everyone knows what is meant by 1. We all know that $1 + 1 = 2$, but how do you prove that the first 1 is the same as the second 1?

Does 1 man + 1 woman = 2 children? Our knowledge of numbers is intuitive. By some means or other as we grow up we come to know that $1 + 1 = 2$ — though not in some cases. Our knowledge of numbers is a clear example of what Aristotle calls inductive logic.

In *A mathematician's apology*, pages 140 and 141, G H Hardy, a mathematician of note, has written: "a real mathematician has his conscience clear; there is nothing to be set against any value his work may have; mathematics is, as I said at Oxford, a 'harmless and innocent' occupation." Hardy suggests that the keynote of mathematics is the ability of the mathematician to create, to transcend reality. He distinguishes between real mathematics and trivial mathematics, where real mathematics is distinguished by the quality of thought.

Take the assertion $1 + 1 = 2$ as perhaps being the most primitive of all axioms in mathematics, assumed by all subsequent proofs. In what can the assertion be justified, as it cannot be proven by more primitive axioms. The only possible justification is that it has always been the case.

The justification must be in terms of our experience, of taking one thing and then another and finding there are two things — though at the subatomic level funny things may happen. The process by which we come to our conslusion that $1 + 1 = 2$ is inductive, and is similar in form to an assertion that the sun will rise tomorrow.

The axiomatic method in mathematics is built upon inductions which are totally reasonable but nevertheless are still inductions. Is it any more reasonable to accept the reasoning in *Principia Mathematica* by Russell and Whitehead than to accept the sun rising?

Induction distinction

A distinction is claimed between what is termed scientific induction and ordinary induction. If we can predict that the sun will rise tomorrow by use of laws of relativity, then it is held to be more convincing than just hoping, because the laws of relativity applied to the solar system depend upon a wider range of inductions. Yet all applied laws are generalisations based on past experience.

Ever since Aristotle, philosophers and scientists have been aware of the key problem of induction. In this century Popper presented a means by which one could evaluate scientific and ordinary arguments. As you can never prove that an argument will be true for all time, he suggests we should investigate ways of establishing the falsity, or incorrectness, of assertions. "There will be a revolution" is an example of an assertion which is inherently untestable because we have not decided when, if ever, the revolution will come. "By 1984 there will be a revolution" is testable, because by 1985 we will know

(continued on next page)

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whether it has happened or not happened.

Popper split arguments into two classes: scientific, that is testable, arguments and metaphysical or not testable arguments. The test always has to be against reality. One could fault arguments by examination of the deductive processes used to relate the initial assertions to conclusions, that is the deductive aspects. In testing against reality you are actually testing the original assertions. If the deductive aspect is correct, then any conclusion is only a product of the original assumptions.

A mathematical argument is, in one sense, an example of metaphysics: there are no testable conclusions, and mathematical induction is simply a variant of axiomatic systems. The case for the initial assumption is based ultimately on inductions such as 1 + 1 = 2. It is then assumed to be true for a later version, and the successor to the later version is then worked out. If the difference between the two versions is according to the formula, then the formula has been correct.

By pure induction it is then possible to generalise that it is true for all cases. This appears to be justified by a rule which allows you to follow on from successive happenings and so, it is claimed, it is in some way different from using laws of relativity to predict the sun will rise tomorrow. The logic involved in moving from the assertion that if it is true for 1 and true for N it is true for N + 1 and for 1 + 1 = 2 is simply inductive. We know that we can replace N by 1 to give N + 1 = 2, but can it be justified by a totally deductive argument?

Commentators who have followed on from Popper, especially Lakatos, have noted that when faced with the collapse of an argument yet with the deductive part of the argument appearing to be correct, it is usual to add extra assumptions to accommodate the new results. The Bohr theory of atomic structure is a good example. Mathematical arguments can be faulted on their initial assumptions, as well as on their process of argument — see *Wittgenstein's lectures on foundations of mathematics.* But when one comes to examine correctness proofs for actual programs, the addition of extra axioms becomes very popular.

Take the trivial program

```
10 A = 1
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put forward as perfectly correct, and therefore a refutation of the argument that there is no thing as a correct program. One only needs to note that there is no Let and no End for the program to be shown to be incorrect, and thus to refute the assertion that the program is correct. When faced with such refutations the automatic reaction of some is to change the grounds for argument.

One obvious way of adding extra axioms is to restrict the type of language and the type of machine. To prove programs correct in a vacuum is pointless — they must run on a specific machine.

It is not possible to leave this topic without mentioning a powerful argument concerning the inadequacy of deductive processes of argument in mathematics. When I called the program trivial I was thinking of Gödel's Theorem, the simplest exposition of which is in Nagel and Newman's *Gödel's proof.*

Gödel showed that in any system which is sufficiently non-trivial to refer to itself, there are assertions whose truth or falsehood cannot be established by derivation from other assumptions. A complex computer language may produce programs which are untestable by mathematical means, if one accepts the truth of Gödel's proof.

Popper wrote in *The logic of scientific discovery* that he did not believe that there was such a thing as a valid inductive argument, because being inductive it could never be established as correct. Popper also wrote that he was not considering mathematical induction, because mathematics was part of metaphysics, that is mathematical arguments had no relation to reality. On page 72 he considered mathematical axioms, in this case those of Euclid, as purely conventions with no relation to reality, or as hypotheses with relation to reality.

My assertion is that though correctness proofs can be useful in establishing consistency in programs they cannot establish correctness in the real world. What is more, the effort involved would seem rather fruitless.

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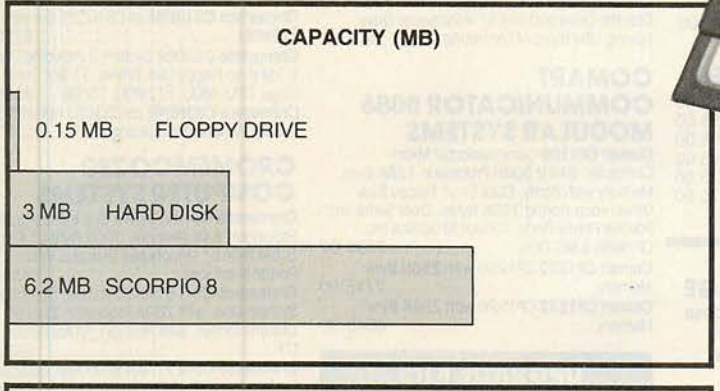

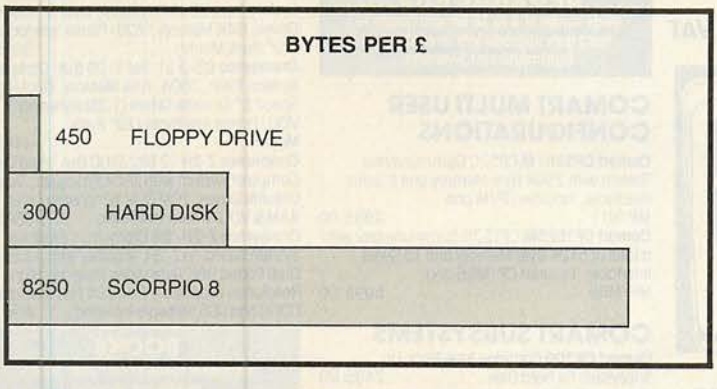

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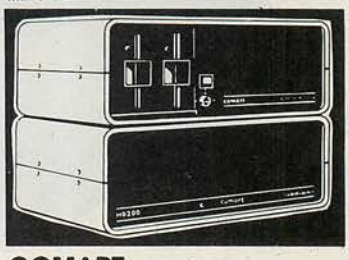

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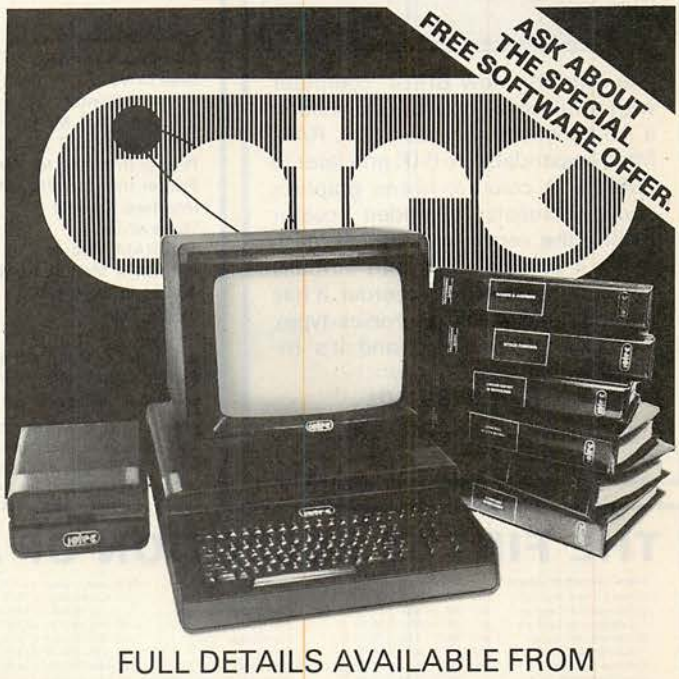

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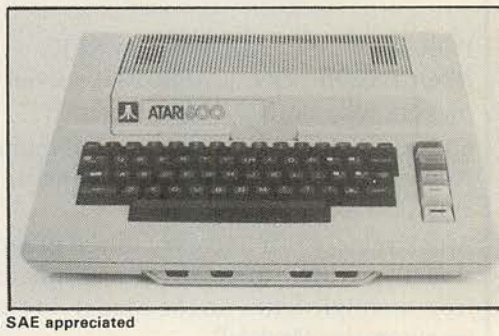

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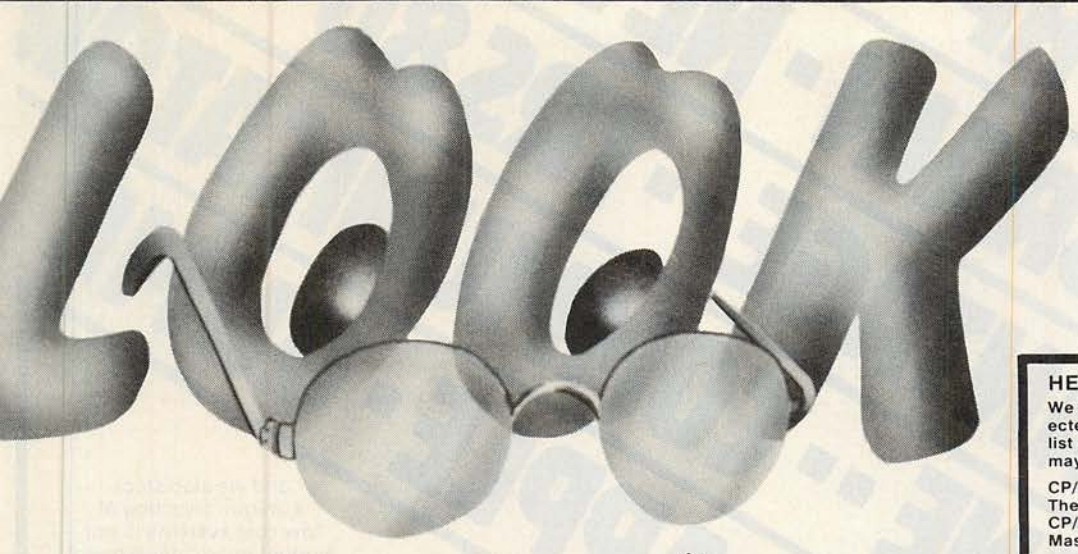

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74LS160	38p
74LS161	36p
74LS162	36p
74LS163	38p
74LS164	40p
74LS165	50p
74LS166	60p
74LS170	70p
74LS173	55p
74LS174	40p
74LS175	40p
74LS181	90p
74LS183	120p
74LS190	36p
74LS191	36p
74LS192	36p
74LS193	36p
74LS194	35p
74LS195	35p
74LS196	45p

74LS197	45p
74LS221	50p
74LS240	55p
74LS241	55p
74LS242	55p
74LS243	55p
74LS244	55p
74LS245	70p
74LS251	30p
74LS253	30p
74LS257	30p
74LS258	35p
74LS259	55p
74LS260	22p
74LS266	20p
74LS273	55p
74LS279	30p
74LS280	100p
74LS283	40p
74LS293	40p
74LS295	90p
74LS298	90p
74LS299	180p
74LS323	160p
74LS324	150p
74LS348	90p
74LS352	60p
74LS353	60p
74LS356	250p
74LS363	140p
74LS364	140p
74LS365	30p
74LS367	30p
74LS368	30p
74LS373	55p
74LS374	55p
74LS375	70p
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74S30	40p
74S32	70p
74S37	60p
74S38	70p
74S51	70p
74S74	75p
74S85	450p
74S86	180p
74S112	90p
74S113	90p
74S114	90p
74S124	300p
74S132	110p
74S133	60p
74S138	120p
74S139	120p
74S157	250p
74S163	300p
74S174	250p
74S175	320p
74S194	320p
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8205	225p
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2 4570MHz	280p
5.068MHz	150p
3 5795MHz	100p
3 686MHz	300p
4 00MHz	150p
4 194MHz	200p
4 43MHz	110p
5 00MHz	175p
5.068 MHz	210p
6 0MHz	150p
6 144MHz	150p
7 0MHz	150p
7 168MHz	175p
8 86MHz	175p
10 00MHz	175p
10 7MHz	150p
12 00MHz	150p
14 318MHz	150p
16 00MHz	200p
18 00MHz	200p
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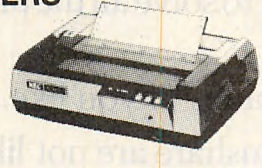

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24" cable with 25 way D. Conn. Male **550p** Female **600p**

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Single	145p	165p	240p	380p
Double	210p	230p	345p	540p

Cable with Sockets

	20way	26way	34way	40way
Single 24"	185p	210p	270p	300p
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	St.Pin	Ang. Pin	Recep-ticles	Edge Conn.
10 way	**90p**	**90p**	**85p**	**200p**
20 way	**145p**	**160p**	**125p**	**240p**
26 way	**175p**	**190p**	**150p**	**300p**
34 way	**200p**	**215p**	**160p**	**380p**
40 way	**220p**	**230p**	**190p**	**550p**
50 way	**235p**	**260p**	**200p**	**600p**

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36 way plug/socket	£5.50
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Available in IDC or Solder version

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No. of ways				
Solder	**95p**	**135p**	**160p**	**250p**
Angled	**160p**	**230p**	**210p**	**425p**
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Solder	**110p**	**160p**	**210p**	**350p**
Angled	**175p**	**240p**	**275p**	**500p**
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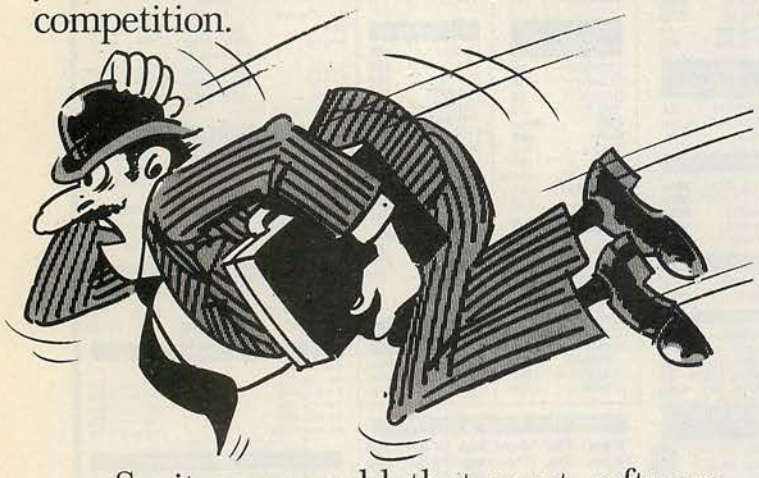
Today, computers, micros and more importantly business planning systems are no longer considered luxuries.

They allow you to keep one step ahead of your business, and one step ahead of the competition.



So it seems odd that most software companies still expect to solve all the problems with one system.

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Fortunately Comshare are not like most companies. We saw the need for different systems to suit different people.

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PlannerCalc at £39.00* is now accepted as the first choice for people new to financial planning.

Designed for 8-bit micros, it boasts the kind of features that you'd expect to pay three times as much for. (Buy PlannerCalc's nearest rival and you'll have to.)

Unlike all other 'calc' products it allows you to enter calculation in a language you understand. Plain English.

So it's much easier to use.

It uses the popular "spreadsheet" approach with a window that can be rolled in all directions.

Which means you can enter new figures and rules and immediately see their effect on everything else in the model.

It comes with the best manual on the market and it's suitable for most micros w a ™CP/M 2.2 operating system, 64K o memory, giving at least 900 cells, minim screen width of 80 characters and floppy disc drives.

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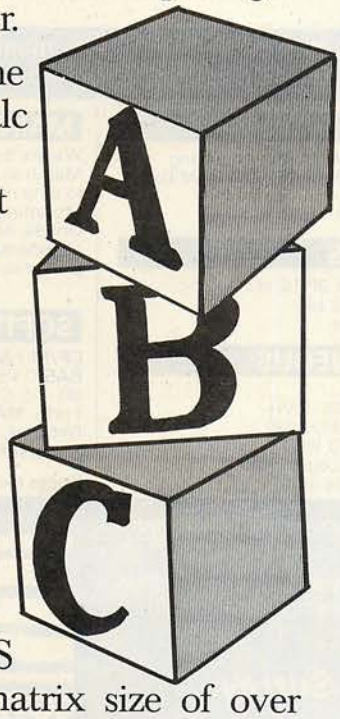

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A new version of sterPlanner has been cifically designed for 16 bit micros like the us 1 under ™CP/M-86 he IBM personal using ner CP/M-86 or ™MS OS 1.1. With a vast matrix size of over 00 cells on 128K and even more with larger mory, you'll at last be able to make the most your micro.

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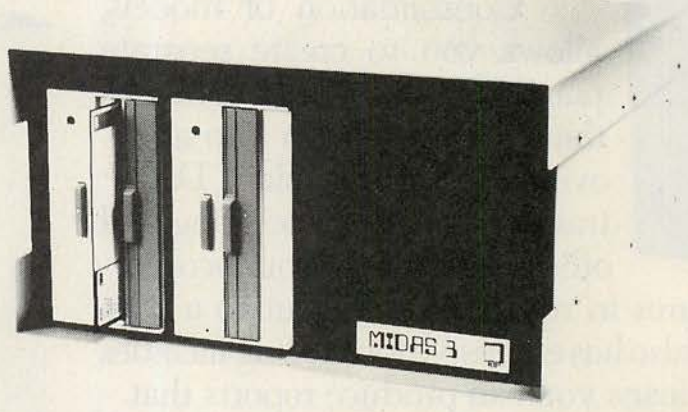

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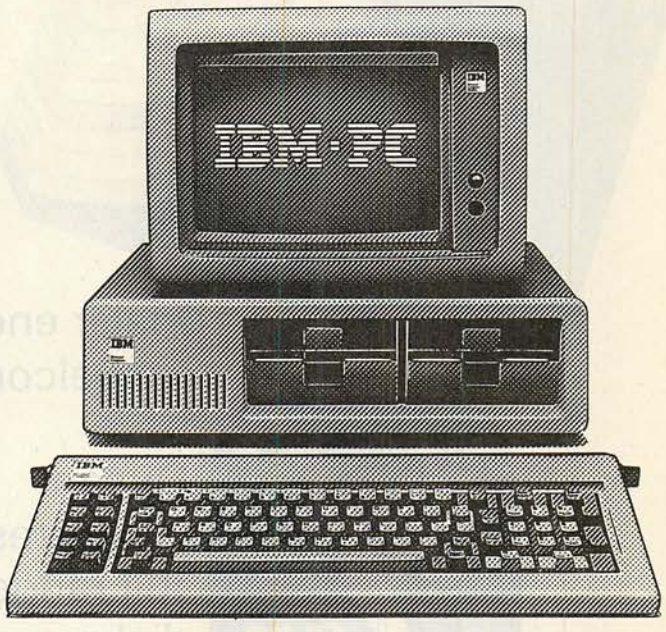

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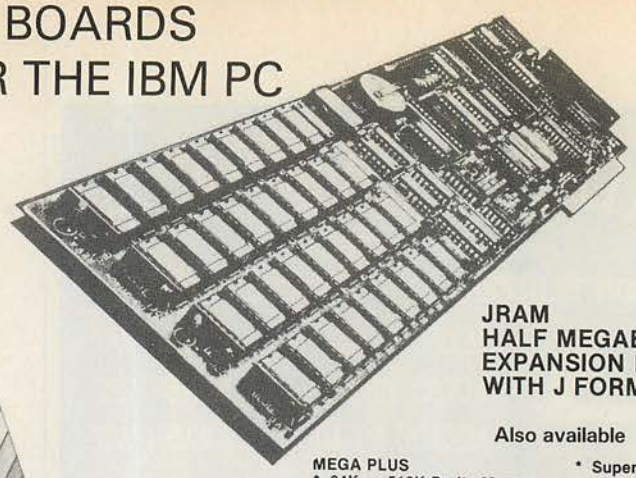

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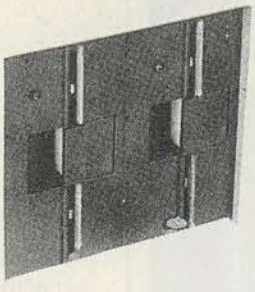

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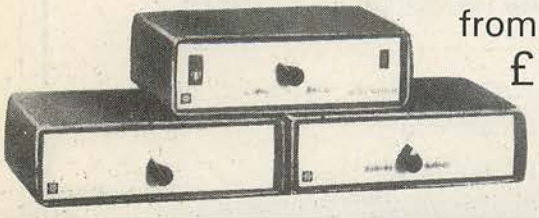

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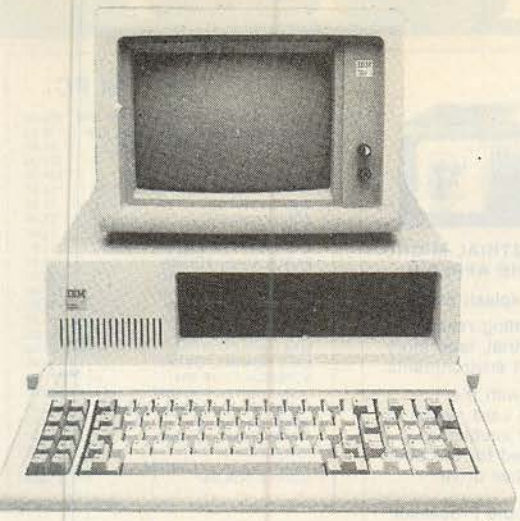

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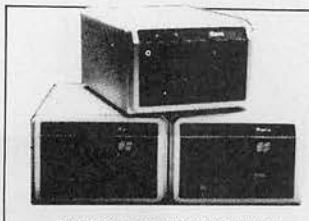

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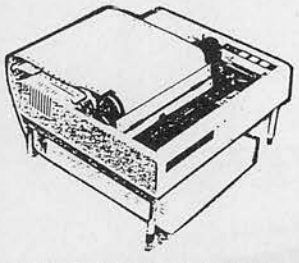

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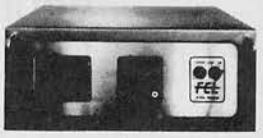

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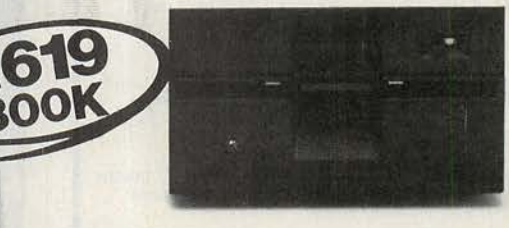

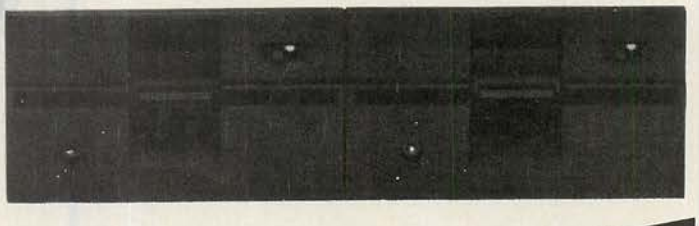

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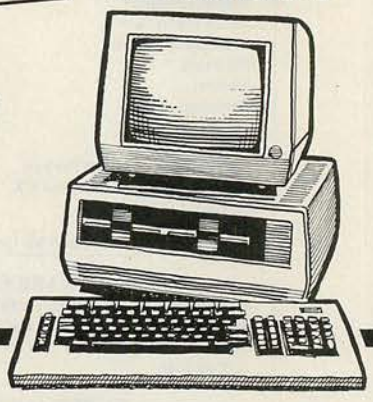

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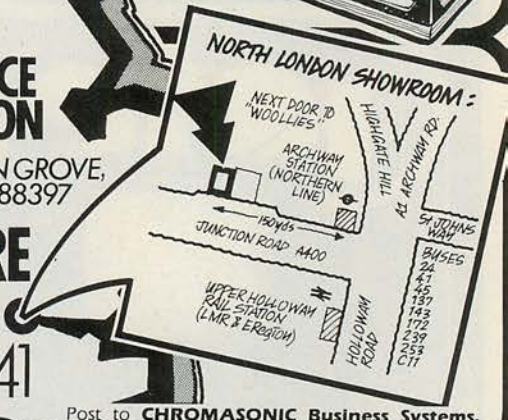

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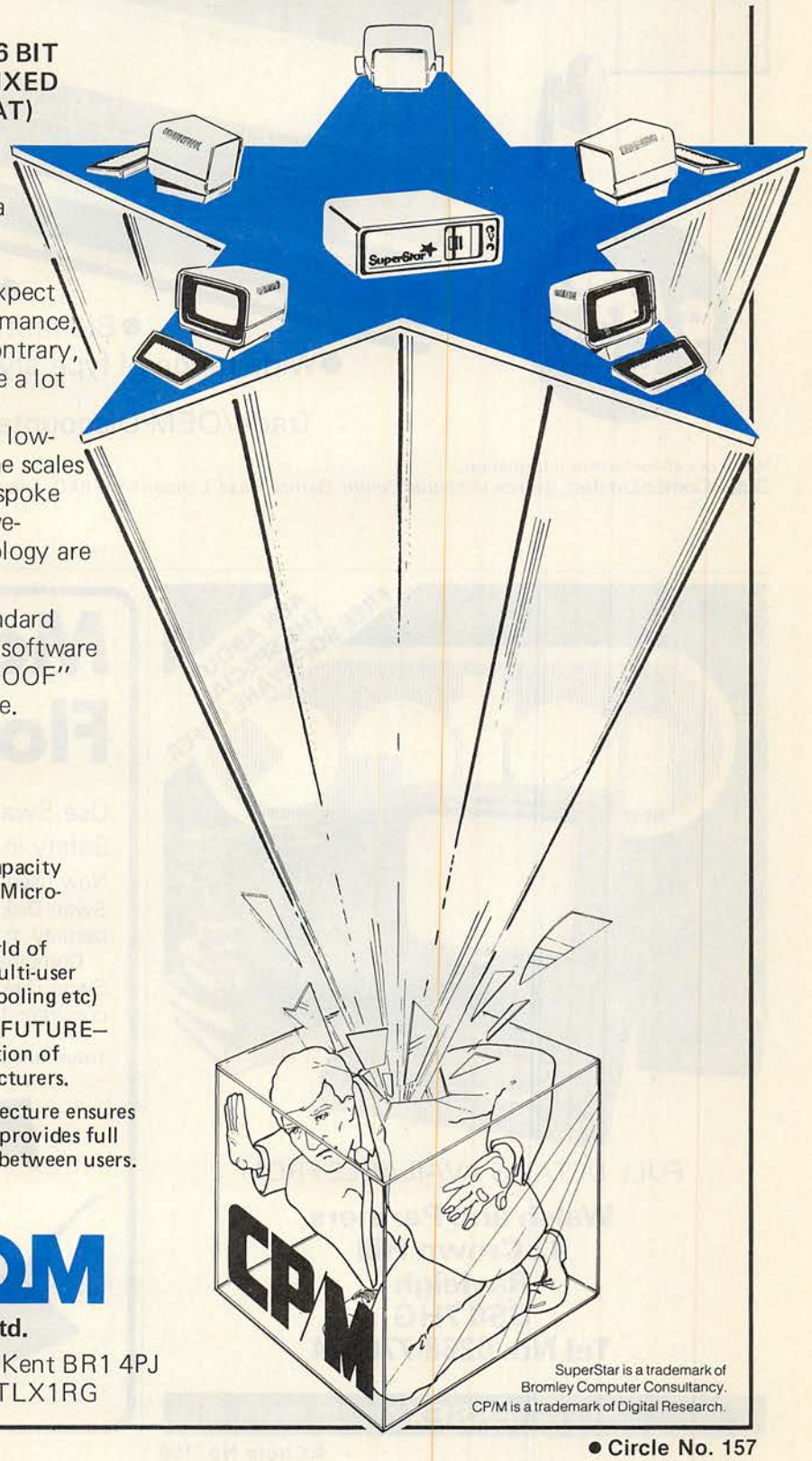

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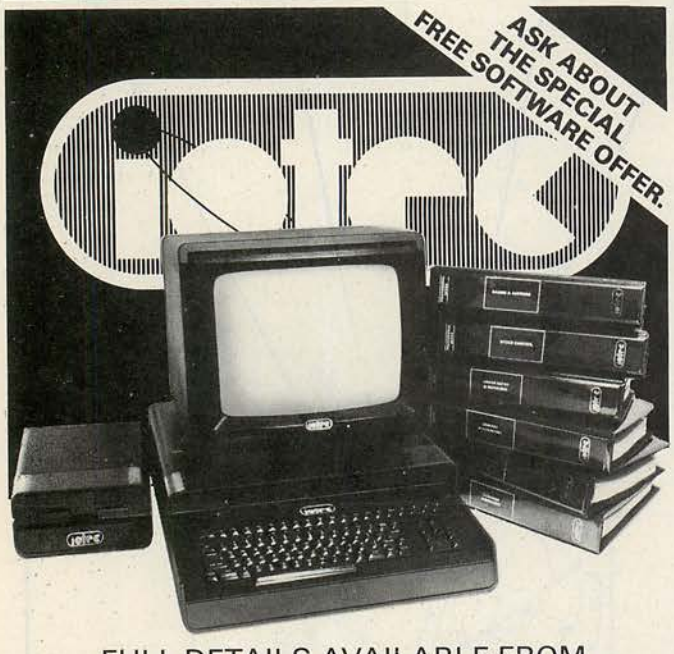

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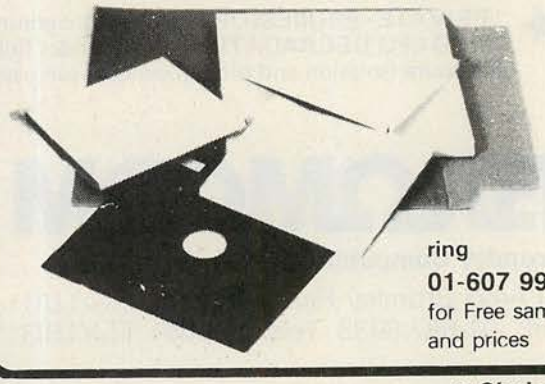

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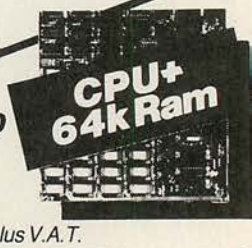

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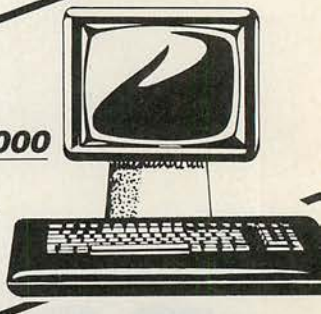

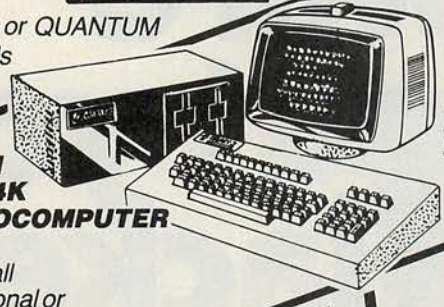

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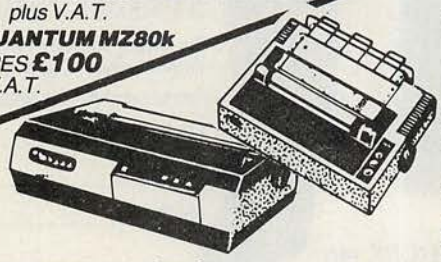

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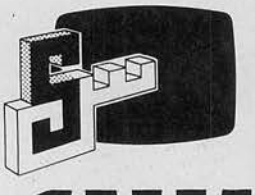

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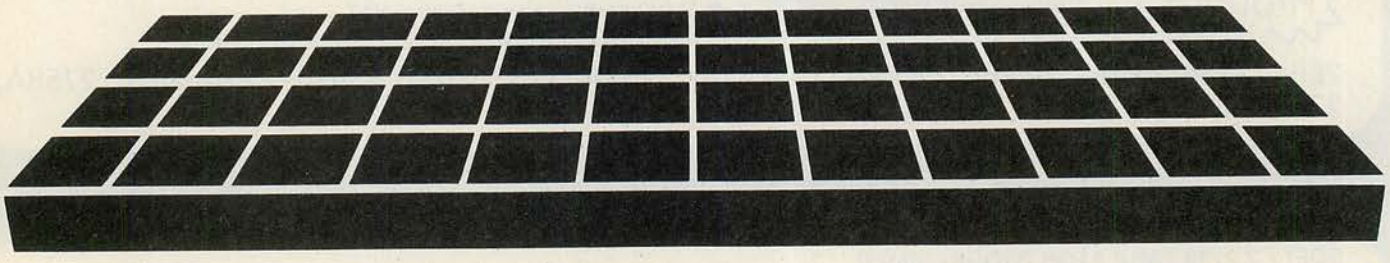

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APPLE Lisa

The long-rumoured Apple office micro lives up to its promise, reports Ian Stobie.

LISA IS the long-awaited Apple IV. It is a 16-bit machine, based around the Motorola 68000, as expected, and comes with a 5Mbyte hard disc and 1Mbyte of RAM as well as two floppy-disc drives. But the distinctive thing about the Lisa is the software, which is, as Apple claims, revolutionary.

While other manufacturers try to decide which operating system will become the 16-bit standard, coming down variously in favour of Unix, MS-DOS, CP/M-86 or whatever, Apple has been more radical by doing away altogether with the operating sytem in the sense of a separate entity the user has to deal with.

Instead, the Lisa comes with a set of application programs covering all the major office tasks, completely integrated in terms of both data compatibility and a consistent command structure. Lisa uses graphics symbols and a special pointing device, the mouse, to simplify control of the system for the user. Additional applications, whether from Apple or from independent vendors, will fit into this overall operating environment.

Details about the Lisa are being announced now though the machine will not be available till the summer. The price will probably be around $12,000, although lower prices have appeared in the U.S. press without confirmation from Apple. It is unambiguously an office machine, intended for use as a personal tool by professional and business people. In the course of an afternoon with the machine I learnt what it is like to use — which is after all the important thing, especially with this machine — but not much about its internal workings.

What then is the Lisa like to look at? When it is not turned on it looks quite conventional. It is a three-box system, or three and a half boxes if you count the mouse. The keyboard unit is on the end of a coiled telephone-style cable. The keyboard layout has not been finalised yet, but it will differ between the U.S. and Europe. The U.K. version will probably resemble the ISO standard keyboard used on the new Apple IIe but with the addition of a separate numeric keypad. In any case, changing keyboards is just a matter of plugging in the

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APPLE Lisa

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new unit. All keys are software redefinable.

The system box contains the screen, two floppy-disc drives and the CPU. The screen is exceptionally clear monochrome white on black, with a resolution of 720 by 364 points. Two of the newly designed, Apple-made 5.25in. "Twiggie" floppy-disc drives, each capable of holding 850K, sit next to it. Also in this unit is the 68000, which is a true 16-bit processor offering both a very large 16Mbyte address space, rapid processing and very good interrupt facilities suitable for supporting multi-tasking software. A full 1Mbyte of RAM lives on two boards inside the unit.

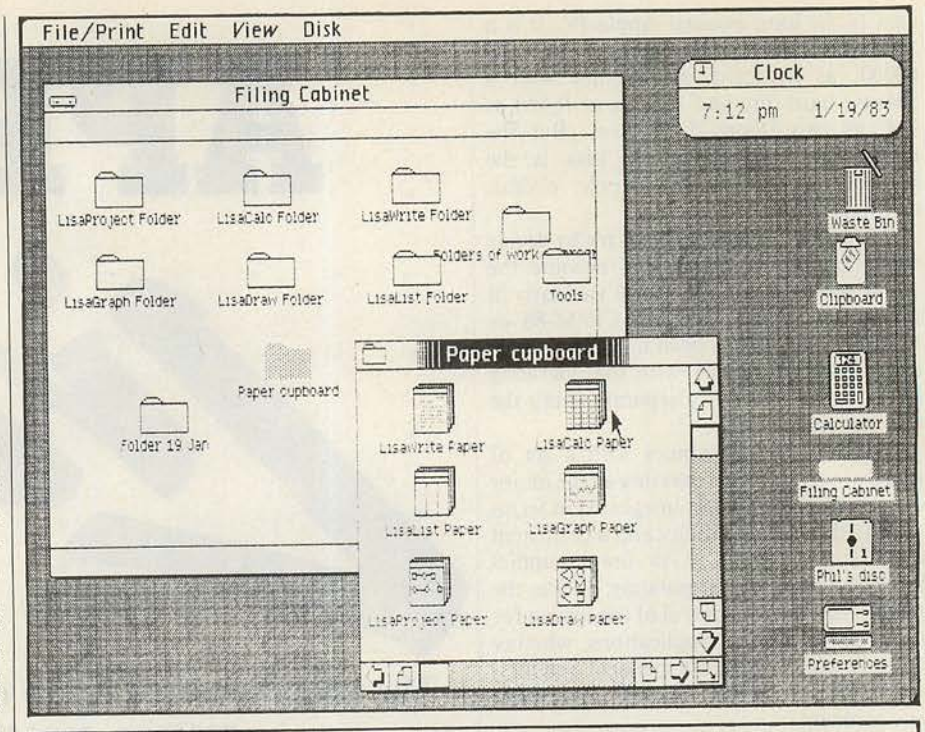
The third box is the 5Mbyte Winchester hard disc looking just like the Profile disc used with the Apple III, which is exactly what it is. Of this, 3Mbyte is available to the user. The large amount of software which comes with the system takes up the remaining 2Mbyte.

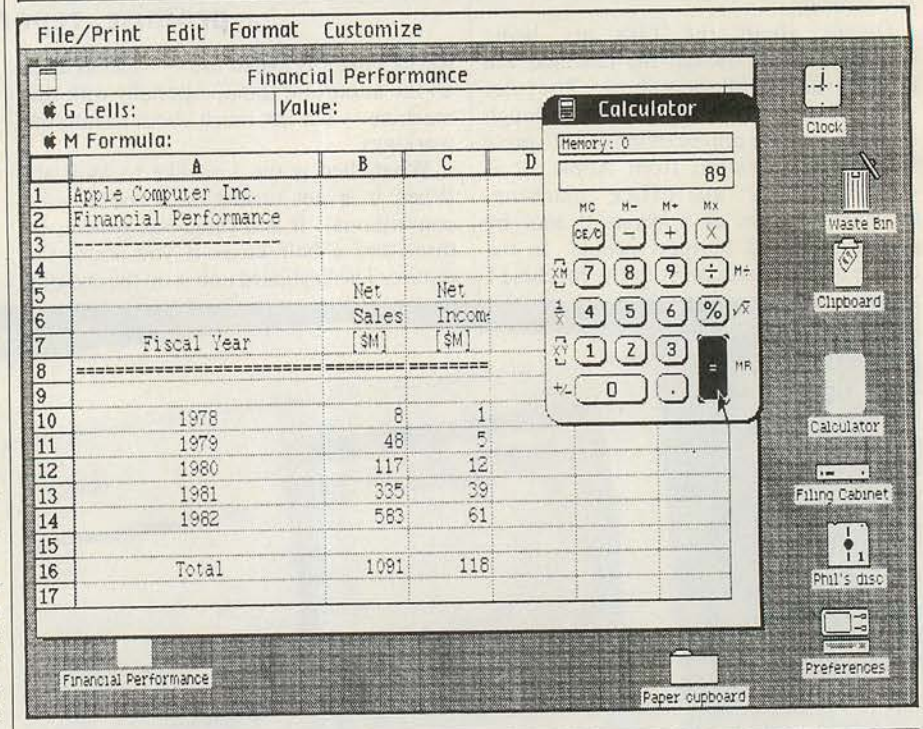
The mouse is a box about the size of a matchbox on the end of a slim cable leading into the back of the system box. It fits snugly in the hand and has a single large button on it. Underneath the box, a small rolling ball detects movement of the mouse on the table. You use it to move a cursor around the screen, and more particularly to select options, which the Lisa usually presents by displaying graphics symbols on the screen.

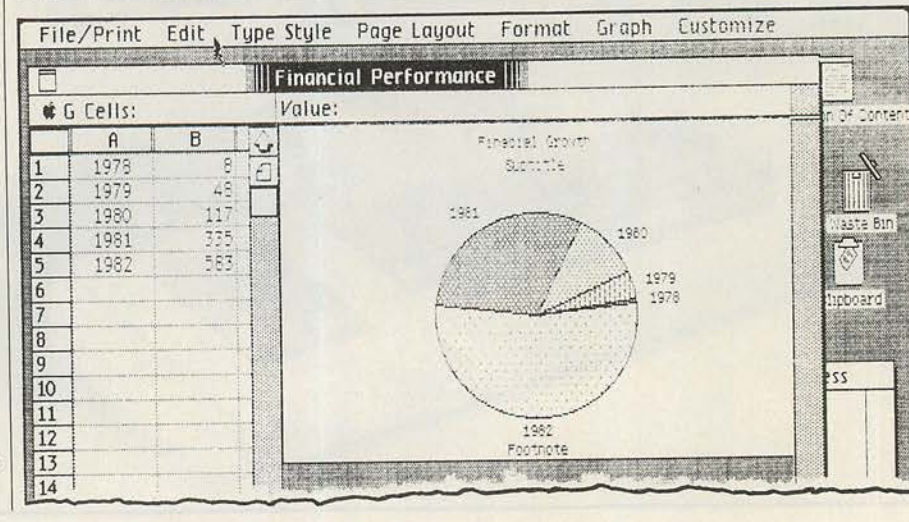
The mouse reduces the necessity to touch the keyboard, which speeds things up as well as making using the system more acceptable to European business people for their own personal use. Apple researchers have apparently discovered that, unlike their American counterparts, European executives — with the exception of German ones — consider typing undignified. Apple is also conducting research into voice input, and this will probably be incorporated into the Lisa interface once the technology is available at a reasonable price.

The Lisa environment is an integrated one where words, pictures and numbers can be handled with equal ease. Integration is at the user-interface level, not just at the internal file level. So it is not really adequate to describe the applications Lisa offers as a set of programs — to the user they appear simply as different tasks or jobs within the overall flow of work.

The metaphor Apple employs is that you are working at a desk. Simulated sheets of paper along with other symbols like waste-







baskets are displayed on the screen. The currently active "sheet of paper" usually appears on top. Since the Lisa is a true multi-tasking system users can swap between tasks as easily as uncovering a piece of paper or taking a new one out of a drawer. In fact these are the precise metaphors employed by the Lisa.

Spontaneous flipping between tasks is encouraged by the speed of the system and the consistency of the command sets used in doing each job. For instance, moving a column when using the spreadsheet involves selecting the same cut, copy and paste options as moving a paragraph when word processing.

Lisa offers solutions to the common jobs which Apple identifies as being the core of the office information worker's task. Incidentally, Apple reckons that half the working population falls into this category, which is one reason for Apple's optimism about the Lisa's future. The tasks are: drawing; writing; calculating; graphing; listing, mailing and filing; project scheduling; and communicating with large computer systems.

For tasks that are not covered here Apple is providing a Pascal development system. It will come with a library of routines to allow the system developer to produce software which integrates smoothly into the Lisa environment, observing the same conventions for consistent handling of the mouse and graphics interface. By the time of launch in the summer, Apple hopes to have the common accounting applications available, produced in conjunction with independent software houses. Basic and Cobol will also be available, but the normal development language for Lisa will be Pascal, which is what the bulk of the Lisa software is written in.

The people at Apple U.K. have tried out the language Smalltalk on Lisa. The whole concept of Lisa's operating-system-free environment and the mouse-controlled desk top simulated in graphics owes a lot to the ideas produced by the Learning Research Group at the Xerox Research Centre in Palo Alto, which developed Smalltalk. This makes comparison between the Lisa software and Smalltalk itself an interesting prospect.

On starting the machine up the Lisa equivalent of a menu appears. Down the right-hand side of the screen is a row of graphics symbols: a wastebasket for rubbish, a clipboard for temporary storage, a picture of the Lisa itself for setting system preferences, a filing cabinet symbolising the main storage, and perhaps a drawer with a name on it for the floppy disc currently mounted.

Placing the cursor over one of the symbols, for instance the filing cabinet, and hitting the mouse button, activates it — or to stick with the analogy, opens it up. If any delay is involved the Lisa changes the cursor to an hour glass. With the Lisa, waiting is always accompanied by a reassuring message of some sort. Error messages are very clear and do not generally stop things dead, although to be honest we only managed to produce on error message in the course of our session

THE SELECTED NAME CAN NOT BE CHANGED

which followed a frivolous attempt to rename the clock. One of the strengths of the Lisa desk-top metaphor compared to an ordinary operating system is that it makes it easy for the user to distinguish between a plausible and an implausible command.

To continue with the same example, opening the filing cabinet brings up a large piece of simulated paper on the screen showing what is in the filing cabinet. Since we are dealing here with a detailed and carefully worked-out metaphor, instead of data files and programs the filing cabinet contains empty folders, titled folders, a few assorted tools like a calculator and a clock, and pieces of paper. The pieces of paper are of various types and are the way into the powerful application side of the system. There is LisaWrite paper, LisaProject paper, LisaList paper, LisaGraph paper, LisaDraw paper and LisaCalc paper.

Cursoring over the LisaCalc paper symbol and clicking the mouse brings up a sheet of blank spreadsheet paper: we are in the Lisa spreadsheet application. Whatever was on the screen before is not wiped out but simply covered up — it can be seen peeping from behind the LisaCalc paper. So if you want to go back and continue your previous task you can. Nothing is deleted unless you explicitly tell the machine you want it deleted. Even if you hit the Off switch, before powering down the Lisa will save all the relevant data and take a snapshot of the current state of the jobs you were doing; when you switch on again your desk top will be there, exactly as you left it.

If while using LisaCalc or LisaWrite paper you are interrupted and need to do a quick computation, then a few swift mouse movements can get out the calculator, lay it in high-resolution graphics over the top of the LisaCalc or LisaWrite paper, and produce the results. Putting the calculator away — two quick clicks on the mouse with the cursor in the right position — reveals the undisturbed interrupted task.

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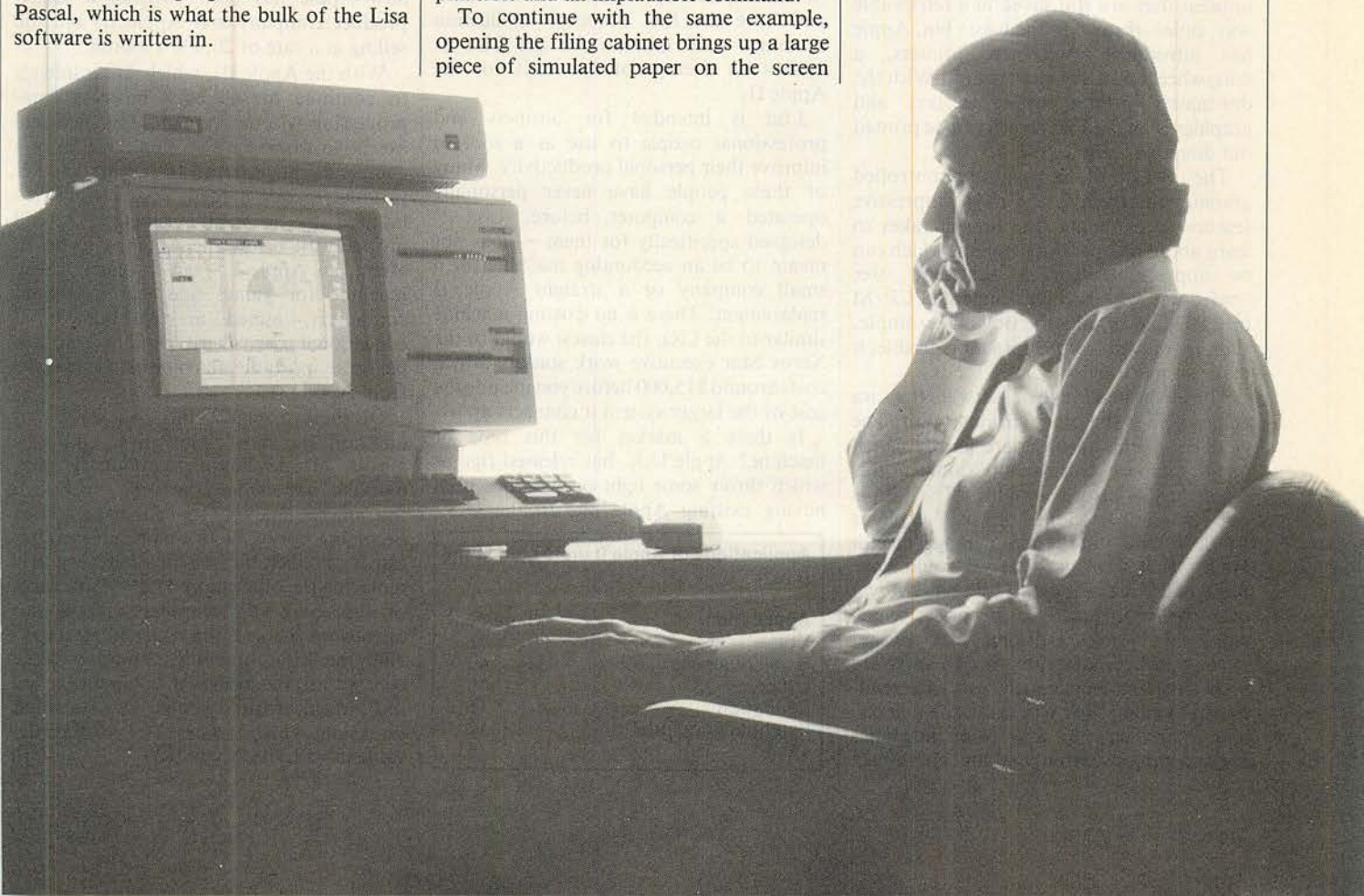

APPLE Lisa

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This all explains why the Lisa had to wait for 16-bit technology. It takes a full-feature 16-bit chip like the Motorola 68000 to handle everything that is going on below the user interface in such a truly multi-tasking environment.

From what I saw of it, LisaCalc looks as powerful as spreadsheet programs of the Multiplan type. Keys as well as commands are used in a consistent way so that, for example, Tab and Return produce movement across the spreadsheet paper and down it, just as you would expect after using the same keys for word processing on LisaWrite paper.

The true power of integrated software shows up once you have produced a column of figures. It really is the work of moments to bring out Lisagraph paper, cut and copy a column across and produce, from the range of options available, a pie chart. The chart can then be incorporated into a LisaWrite document, or it could be cut and copied on to LisaDraw paper where further additions and manipulations could be made.

Used pieces of paper can be filed in named folders in the filing cabinet. If untitled they are still saved in a retrievable way, unless thrown in the waste bin. Apple has introduced two new printers, a daisywheel and a dot-matrix unit. With the dot-matrix printer whatever text and graphics is on the Lisa screen can be printed out directly if required.

The Smalltalk-like mouse-controlled graphics interface is the most impressive feature. It eliminates the time it takes to learn about an operating system, which can be appreciable for a first-time user confronted with badly documented CP/M or CP/M-86 to take the obvious example. This not only makes the Lisa more usable, it make sit more sellable.

The integrated range of software the Lisa comes with is the other striking point. The wonders of the hardwae are hardly worth mentioning by comparison, and in this Apple has its priorities right. "The Lisa is not just another 16-bit hot box," explains Apple's U.K. marketing manager Keith Hall. "If it was just that we could have brought it out a year ago." Lisa has 2Mbyte of software included in the price, which Apple says it took 200 person years to write.

A number of integrated software products from independent software vendors are making their way on to the market, and if 1982 was the year 16-bit machines and portables started making an impact then 1983 looks like being integrated software year. Lotus Developments 1,2,3 for the IBM personal computer has received much praise in the U.S., but VisiOn from VisiCalc supplier Visicorp looks like being the closest thing to Lisa's software.

VisiOn also uses a mouse and Visicorp says it will be available this summer too. Without seeing VisiOn in operation it is not possible to say how much Apple gains by being able to optimise code for its own machine. What is clear is that Lisa exists now, and it is impressive. The investment necessary to bring out an integrated-software product must restrict the number of companies able to enter this market.

Although outshone by the software, any 16-bit 68000-based machine from as important a company as Apple — which claims to have sold 750,000 personal computers worldwide — could be expected to have an impact on the micro market. With the Lisa the radical nature of the software approach Apple has adopted makes the extent of this impact difficult to predict.

A very competitive atmosphere is predicted by Arthur Rock, who is a director of Apple, as well as of chip maker Intel. In Apple's annual report he says: "It's crucial to stay ahead of the competition: bring out products that fill different needs, and not just the same needs better." Lisa is an example of this strategy in action.

Lisa fits this description because the integrated software, concealed operating system and mouse-controlled user interface make the system very easy for the first-time user. Apple itself claims an order-of-magnitude improvement in the time taken to set the system up, become familiar with it and have the first practical application running — 20 minutes for the Lisa as against an average of five days for the Apple II.

Lisa is intended for business and professional people to use as a tool to improve their personal productivity. Many of these people have never personally operated a computer before. Lisa is designed specifically for them — it is not meant to be an accounting machine for a small company or a straight Apple II replacement. There is no existing machine similar to the Lisa; the closest would be the Xerox Star executive work station, which costs around $15,000 before you include the cost of the larger system it connects up to.

Is there a market for this type of machine? Apple U.K. has released figures which throw some light on who has been buying existing Apple kit. In the U.S., where disposable incomes are higher, the Apple II sells more heavily to the home market. But the really distinctive feature of the U.K. market is the use of the Apple II as a small business data-processing machine, which is not really using it as a personal computer at all.

Applications of Apple II units sold in the U.K.

Application	percent
Home	7
Small business	46
Office	18
Education	11
Scientific/industrial	12
Other	6

Summary spec

Manufacturer: Apple Computer Inc.; made in United States
Price: around $12,000
System: 5Mbyte hard disc, two 850K floppies, detached keyboard, "mouse" pointing device; high-resolution display, 16-bit Motorola 68000 processor; 1Mbyte of RAM
Software in price: LisaWrite word processing; LisaCalc spreadsheet modelling; LisaList filing and mailing lists; LisaGraph business graphics; LisaDraw general-purpose graphics; LisaProject project sheduling; LisaTerm terminal emulation TTY, DEC VT-100 and IBM 3270 protocols
U.K. distributor: Apple Computer (U.K.) Ltd., Eastman Way, Hemel Hempstead, Herts HP2 7HQ. Telephone (0442) 60244. Available summer 1983.

This reflects the comparatively large number of small businesses in the U.K. and also their more parsimonious nature. The real unexploited growth area, Apple believes, exists is the office sector. It is represented by only 18 per cent of Apple II sales, in spite of the fact that there are said to be 10 times as many office situations as small businesses in the U.K.

At the same time as Lisa is being announced, the updated version of the Apple II, the IIe, is being launched. Up to now Apple has been virtually a single-product company and Apple IIs are still selling at a rate of 20,000 a month.

With the Apple III, which Apple intends to continue to sell as a business data processing system, and the Lisa, a personal executive work station, Apple will have a complete range. And there is another product, code-named Macintosh, rumoured to be in the pipeline. It will probably fit below the Apple II to be, in effect, an Apple I — an extremely cheap machine for games and learning about computers, aimed at the home and educational user. There does not appear to be a truly portable machine on the horizon from Apple.

Of these machines the Lisa is without question the most innovative, and it is aimed at developing completely new markets for personal computers. Just when the micro market looked like it was becoming boring, with well-engineered but rather predictable 16-bit crates merely replacing the old standard CP/M machine or replacing minicomputers, Apple has opened the whole thing up by taking a risk. And the Lisa forcefully reintroduces the concept of the personal computer as a individual tool, almost a personal extension, which is where Apple originally came in with the Apple II.

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Memory	4K-byte ROM; 48K-byte RAM; + 2K-B Video RAM.
Display	9 inch (23 cm); 40 characters x 25 lin Green screen.
Cassette	Manual control; standard audio casse tape. Data transfer (Sharp PWM sys 1,200 bits/sec.
Keyboard	ASC11 keyboard; upper-/lower-case alphabet; graphic symbols; numeric keypad.
Other features	Built-in clock and music function. Auto repeat on all keys. 2-page video RAM (allows the scree be scrolled up and down). *CP/M available.
Options available	Tape based Pascal Interpreter. Tape based Machine Language packa Sharp FDOS including BASIC compile Tape based Z-80 Assembler package.

ter cifications	Optional Printers MZ 80P4	MZ 80P5	MZ 80P6
ting method	Serial impact dot matrix		
d method	Variable sprocket; Friction	Variable sprocket	Variable sprocket; Friction
s of characters	230		
racter make-up	9(W) x 8(H) dot matrix (normal-size characters)		
ber of digits	136/68 per line 160/80 per line	80/40 per line 136/68 per line	
ing speed	150 cps (normal-size characters)	80 cps (normal-size characters)	
d sweep direction	Bi-directional		
r functions	• Software-controlled full graphic function • Programmable number of lines per page • Battery-operated memory of HOME position (MZ 80P4 only)		

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LYNX

Despite its unassuming appearance Camputers' new micro promises CP/M capability for under £500. Bill Bennet tested it out.

THE LYNX MICRO sits on a fence: it does not know if it is a home computer or a "serious" computer, and this dilemma is reflected in its £225 price tag. It sits at the top of the home-computer price range but it is probably too cheap for business computer users to take it seriously. What they should take seriously is the fact that the Lynx is more powerful than the Apple II and about half the price.

Just who is going to buy the Lynx is not yet clear. It would be an ideal machine for the classroom but unfortunately it is not yet on the official list for educational buyers. The Lynx is also an ideal machine for someone who suspects that they need to find out about computers today, and may need a proper computer at a later date.

Although the casual observer can be forgiven for thinking otherwise, the Lynx is certainly more than a toy. It can quite quickly grow into a fully fledged CP/M system, and you will not have to pay the earth for that either.

There are four main components to a CP/M system: a Z-80 or 8080 processor, 64K of user memory, a floppy-disc unit and the CP/M systems disc. The first comes as standard in the Lynx, which uses the Z-80A running at 4MHz. The Lynx comes with a standard 48K of memory but it can be extended in steps of 64K up to a total of 192K.

Although the standard memory is 48K, this cannot have been in the original design spec as some of the RAM within the case is on a board marked "memory exp". The first stage of memory expansion takes the total RAM size up to 96K — more than adequate for a CP/M system. Expanding the memory size above 128K gives the added advantage of still higher resolution than standard or a possible 80-column display width.

A floppy-disc unit is the component which is most frequently the barrier between home computing and serious processing work. Until recently it could not be crossed without the user shelling out a small fortune, but this has now changed. In the same way that scaled-down microcomputers became much cheaper during 1982, mass-storage devices will be less expensive in 1983.

The Lynx disc unit should be available later this year. It will be a single-sided, single-density unit at the knock-down price of slightly under £200. It will only be capable of storing 150K on each disc, which is not very much and means that at least two drives will be required for any work that involves a lot of files.

At around £500 for a CP/M machine, the Lynx is a formidable micro. What makes it particularly useful is the way that the system can be put together piecemeal, as the user's needs and budget allows. Lynx users will not need to scrap their machine because they have grown out of it, or at least not straight away.

Once the CP/M Lynx is up and running the user can begin to amass a collection of software and data which is not wasted since it can, if necessaary, be transferred to another CP/M machine. Thus the Lynx offers the curious but potentially serious micro user a growth route that avoids waste. For the same reasons the Lynx would be ideal for schools and educational establishments. Users who just want to play games will also like the Lynx's facilities.

Anybody already acquainted with a low-priced home computer will appreciate the

Lynx's keyboard. It is probably the best keyboard available in its price range, with a typewriter-like central section and the usual special keys arranged around this core and marked in red. What I liked most about the keyboard was the unclutteredness — none of those horrible graphics characters printed on the side of the keys, or unreadable orange keywords above them. One fault is that a key depression is sometimes not noticed by the machine.

The quality of the keyboard, together with the ability to run CP/M, means that the Lynx can form the basis of a cheap and yet fairly efficient word-processor system. For example, a full WordStar system could be yours for about £550 plus the cost of a printer. There is to be a special Lynx printer, though it could in no way be considered as a letter-quality one: it will sell for under £100, and print in ink on tally-roll paper.

Users who are a little more fussy about print quality will be able to hook up the printer of their choice via the non-standard RS-232 output on the rear of the case. Rather than use a standard RS-232, the Lynx uses a DIN socket. The signals present are RS-232 in, RS-232 out and zero volts. The manual hints, on page 53, that if you want to hook your own printer up to the Lynx you might have to spend an evening soldering components together to build an interface. Having tried this in the past, it is not something I would recommend.

On the whole, the manual supplied with the review machine was adequate, and I understand a new one is being written. The main flaw is the lack of examples; concepts are explained fairly well, but they are not put into any context by example programs. It is nothing like as useful as the Sinclair Spectrum manual, which includes just about every piece of information the user could wish for.

Basic is the language used by the Lynx, a fact which will surprise no one. Forth will shortly be available and should be of great use to those interested in exploiting the excellent graphics available on the micro. I would also like to see Logo added to this list.

Lynx Basic is fine, but it has some odd quirks. The most annoying is that a variable name can only be a single character: a maximum of 52 variables is available using both upper and lower-case characters. This limitation seems to be at variance with the structures included within Lynx Basic; after all, what is the point of including program structures that make a listing easy to read when the variable names are so cryptic?

The structures themselves are certainly welcome. As a full convert to the concept of named procedures I found the automatic indentation showing the program control very useful. However, debugging programs is made more difficult than it should be by the way the screen scrolls. Unlike most micros, the Lynx returns to the top of the screen when it has reached the bottom. If a program is longer than 24 program lines it will write the 25th line over the first.

Editing is also organised in a way that is different from just about every other microcomputer. To remove a line you must type in Del. The command has a similar format to List: that is, typing

```
DEL 100,200
```

will delete all those lines from 100 to 200. There is a Trace facility which can be switched on or off, listing all the program lines as the control reaches them. It is even possible to slow down the operation of a program by using the command Speed which will delay the computer between each program line. The Line Edit mode is entered by typing either Control-E to edit a specified line, or Control-Q to edit the last line.

In addition to procedures Repeat-Until and While-Wend are available to satisfy the structured programming lobby, and they are wecome commands. The old favourite Gosub-Return is included too, of course. The Pause command is one that is appearing on a lot of micros these days. Its effect is to stop the computer from actually doing anything for a specified length of time.

Every computer claims high-resolution grpahics on its specification. The Lynx has higher-resolution graphics than any other micro in its price range, and what's more it is capable of mixing all eight of its colours on screen at the same time. Nominally resolution is 248 by 256 pixels, but a memory expansion allows a resolution of 248 by 512.

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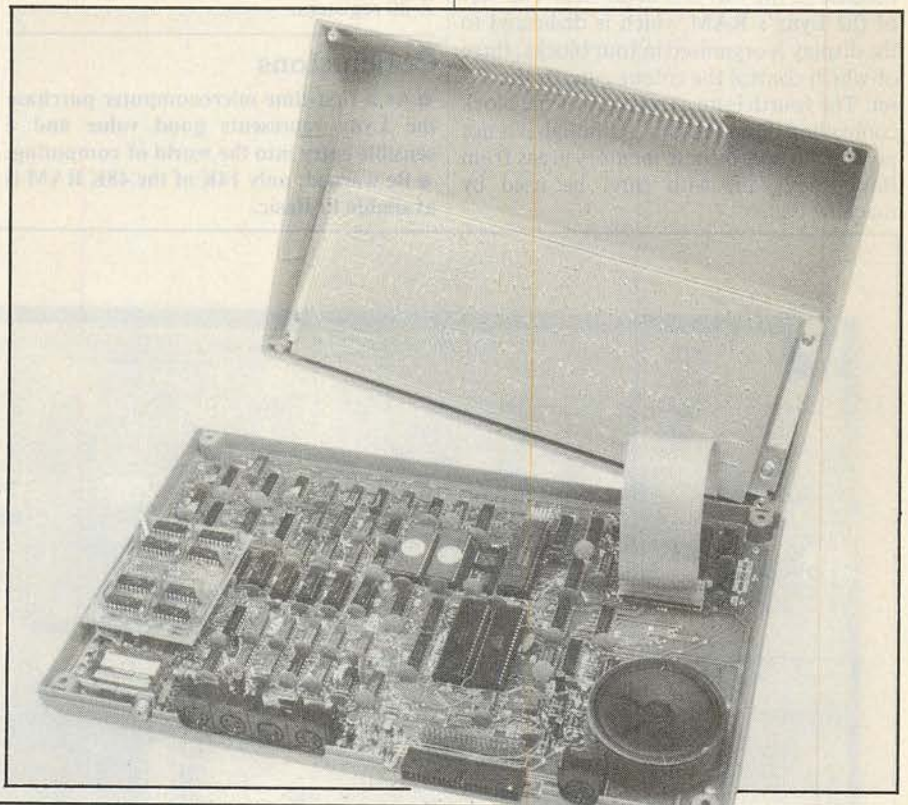

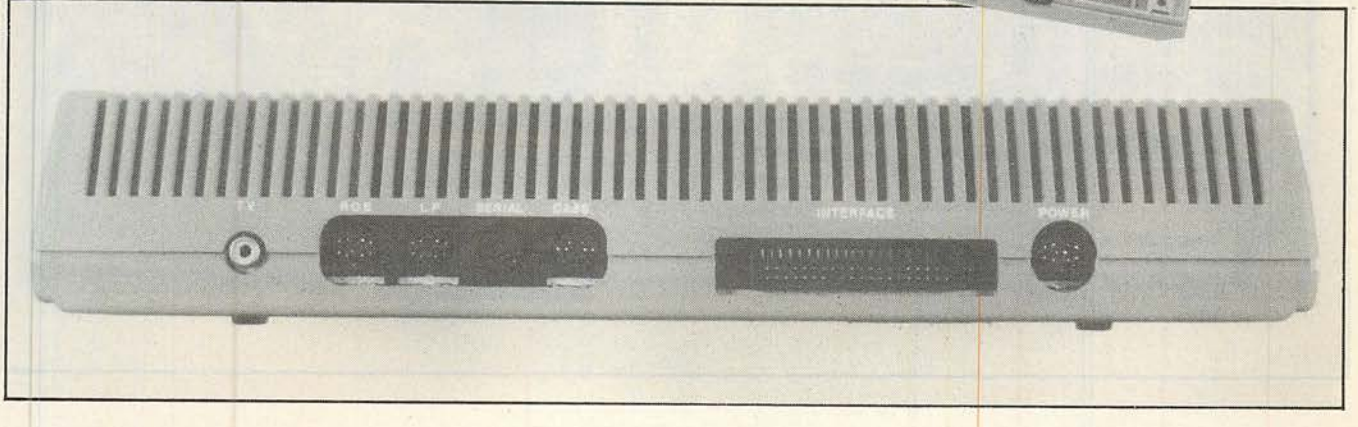

LYNX

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There are a number of features of the Lynx's graphics ability that are extremely powerful. My favourite is the way in which you could write Ink Red to write in red and Paper Green to write on a green background.

Printing characters on the screen in the normal way is easy enough, but there are some novel optional methods too. For example, a text string can be printed in any colour, and a VDU command makes it possible to overwrite existing text. By using the special Print@ command you can print a text string at any one of 120 by 240 points on the screen, a facility that can be used to print subscripts and superscripts.

Printing and using the Basic high-resolution commands are the only ways of creating displays with the Lynx. It is not possible to Peek or Poke the screen memory because of the way it is organised. The 32K of the Lynx's RAM which is dedicated to the display is organised in four blocks, three of which control the colour guns of the TV set. The fourth is an extra copy of the block controlling the green gun. Although it is not possible to access these memory areas from Basic they can, with care, be used by machine code.

The Protect command will make it essentially impossible to change the contents of a particular memory. For example, Protect Red freezes the memory controlling the red gun. Nothing else can be written in Red and everything already written will remain.

Designing a custom character set is rather fiddly, though rewarding. It is possible to play around with the cursor should you ever get bored with the flickering square. You can even designate a particular area of the screen to be the text window.

From Basic there is not much that can be done as far as making music is concerned. All there is to play with is a Beep statement, though the Sound command will send bytes from memory straight to the Lynx's six-bit sound output. The output is in turn connected to a loudspeaker, which is too quiet for my taste but will appeal to those people who jump at the sound of video games.

A machine-code monitor is included as standard and will be of real use to Z-80 machine-code programmers. It includes a front panel which displays the status of the Z-80 registers.

Conclusions

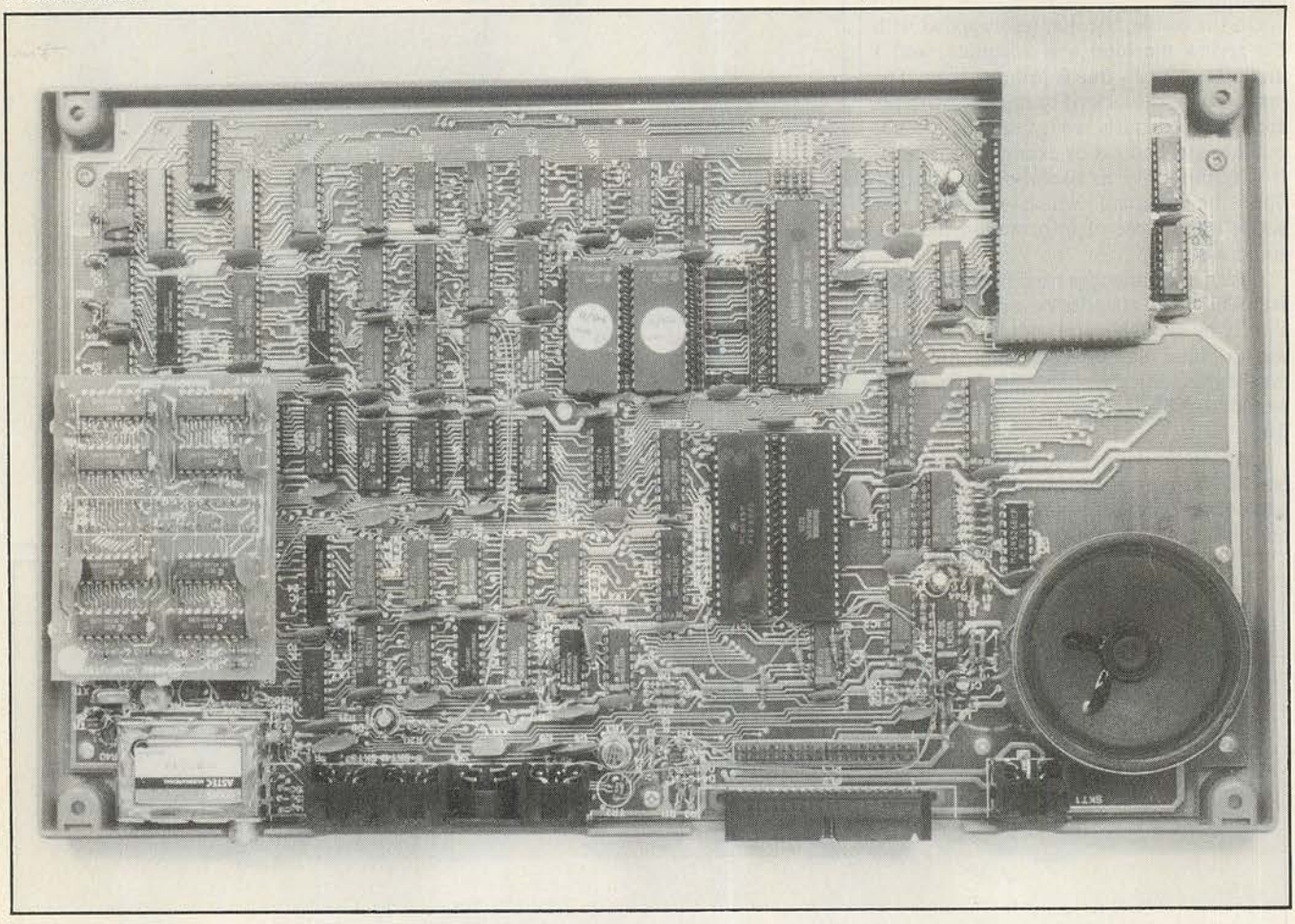
● As a first-time microcomputer purchase the Lynx represents good value and a sensible entry into the world of computing.

● Be warned, only 14K of the 48K RAM is available to Basic.

● The Lynx Basic has both strengths and weaknesses: arrays of more than one dimension are not possible without the user resorting to confusing programming gymnastics.

● The real keyboard and CP/M potential make the Lynx a serious micro, and the sound and high-resolution colour graphics make it a fun micro as well.

Processor: Z-80A
Speed: 4MHz
Memory: 16K ROM; 48K RAM of which 32K manages the display
Keyboard: QWERTY standard-pitch typewriter-like keys
Display: 40 x 24 characters as standard; 80 x 24 on expanded machine
248x256 pixels standard; 248x512 pixels on extended machine
eight colours which can be resolved to a single pixel.
Sound: Internal speaker, accessed by Beep command from Basic, or directly from machine code: includes a six-bit digital-to-analogue converter
Language: Camputers Basic, plus a machine-code monitor
Cassettes: User-defined baud rate; Verify command; will work with most recorders.
Ports: UHF TV; RGB + sync; composite video, mono monitor and light-pen; RS-232 serial port; cassette port; parallel expansion port.
Dimensions: 65x215x345mm.
Manufacturer: Camputers Ltd, 33a Bridge Street, Cambridge CB2 2UW



FUJITSU SP-830

Speed, simplicity and ease of maintenance are keys to the design of this daisywheel, reviewed by Chris Bidmead.

ZYGAL DYNAMICS grew up as U.K. distributor of the Diablo range of printers, but at the beginning of last year Zygal took on board a rival daisywheel from Japanese mainframe manufacturer Fujitsu. What at first made the Fujitsu SP-830 so attractive was its speed, although initial claims of 80 characters per second have been somewhat toned down to the current advertised figure of 70cps. As you will by now have realised, the brochure rate for daisywheel printers is not the same as the real-life speed, so no one will be very surprised that our bench tests show the printer as performing some 30 percent slower than the quoted figure.

Nevertheless the machine is fast, and its speed in the graphics test was particularly impressive. The key to this, which also promises increased reliability and maintainability and other such good things, is the simplicity of its drive mechanism, which makes the pulleys and wheels of the traditional approach look like something out of the middle ages.

All that drives the print head backwards and forwards across the page is a helical groove in the horizontal support bar. The support bar rotates under direct control of the linear motor, so a pin projecting from the underside of the print head is driven laterally. Imagine a bolt being rapidly and repeatedly screwed into and out of a nut, where the bolt is fixed laterally and the nut is not allowed to rotate, and you will have a picture of how the transfer of motion works.

You may also have some idea of the forces of friction involved. Friction is the one big hazard here because any wear in the groove will quickly manifest itself as character misalignment. A sloppy fit can be expected to accelerate the wear as the smooth, sliding action deteriorates into a savage hammering between the oversized walls of the groove.

Perhaps this explains why until recently we have only seen this elegant driving method used in dot-matrix printers, where character alignmemt is possibly regarded as less critical. Is Fujitsu compromising with quality? On the basis of practical experience the answer is definitely no. I used the machine extensively during the test period, and even after a couple of months the alignment was still as good as ever.

Fujitsu has obviously put a lot of careful thought into this crucial pressure point, and the solution is as elegant as the main idea. The rotating helix is a solid bar of case-hardened steel and the pin is a softer metal deliberately designed to wear preferentially. It saves the bar in much the same way that hawthorn needles save precious 78s. To avoid slop the pin is tapered, as is the cross-section of the groove. The pin wears, the

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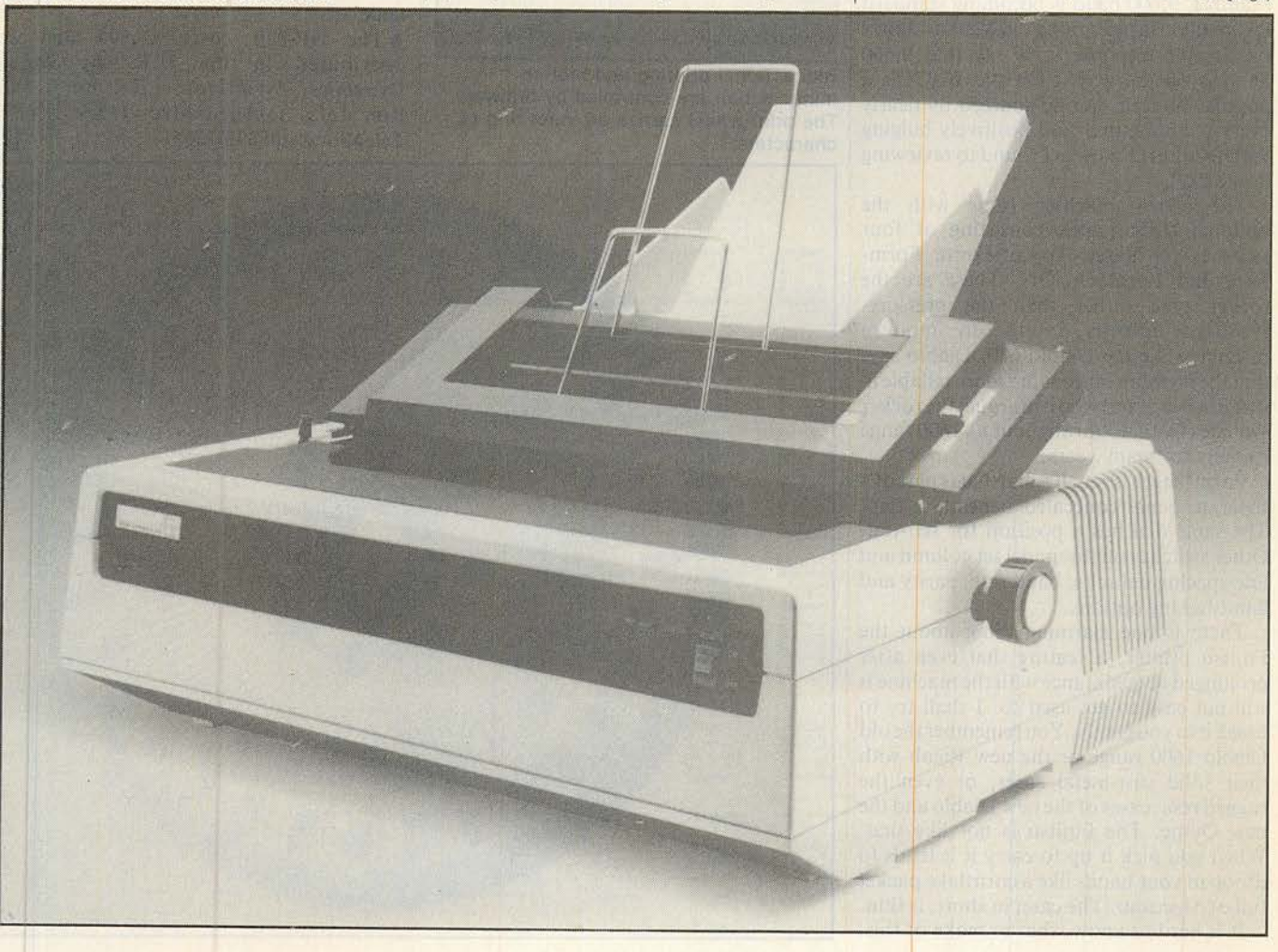

Motion minimisation is excellent.

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spring-loading at its base forces it into the taper, the fit is maintained. After a year or so you simply replace the pin.

The print head itself has been pared down and with the ribbon removed there is nothing to obstruct it from being unlatched and pulled back through almost 90 degrees, which makes print wheel changing very simple. The print wheel itself is full of interesting possibilities; while being fully compatible with the Diablo standard it is also capable of carrying an additional inner ring of characters, bringing the total character set up to 127. Accessing these characters implies a shift mechanism in the print head, something like the famous Ricoh dog-bone, but unfortunately the review machine came without this feature.

Judged by the standards set by machines like the Flowriter the buffer is small, although adequate to support full bidirectional printing. Motion minimisation is very good indeed, as the formatted-text test shows — see table. The interface is RS-232 with provisions for XOn/XOff handshaking or hardware handshaking on the DTR line. ETX/ACK is not catered for, which is a pity.

More serious is the fact that the top speed is 1,200 baud. No daisywheel printer can steadily keep up with this data rate so there is no great loss of throughput here. It is really more a matter of having the flexibility to match a wide range of host speeds — for example, 9,600 baud is becoming standard in many installations. Zygal's fairly predictable response is to say that 9,600 baud is on the way. "On the Way" is a popular product second-sourced by nearly every manufacturer and positively bulging with features. I must get round to reviewing it one day!

The review machine came with the optional front panel, consisting of four switches for Reset, Top-of-Form, Form-Feed and Local On/Off. These are the rocker type rather than the pressure-sensitive buttons found on modern machines like the Diablo 630. Diablo says that the pressure buttons are more reliable in sustained use, and who can argue: the rocker switches featured throughout its 1600 range printers for many years.

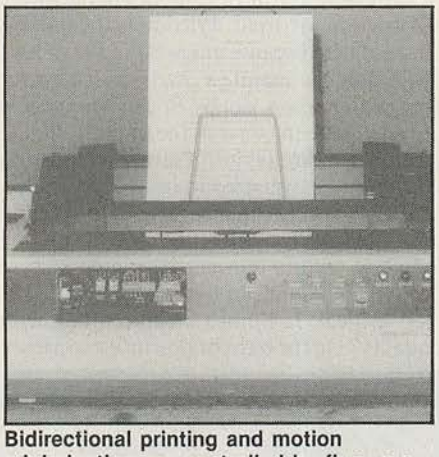
Form length is set on a dial that is part of a separate panel concealed beneath a flap. The same dial has a position for self-test. Other switches on this panel set column and line-spacing defaults, baud rate, parity and handshaking options.

There is one alarming thing about the Fujitsu printer, a feature that even after prolonged acquaintance with the machine is still not easy to get used to. I shall try to break it to you gently. You remember the old Diablo 1600 range or the new Ricoh with their solid cast-metal cases, or even the rugged resin cases of the new Diablo and the new Qume. The Fujitsu is not like that. When you pick it up to carry it it tends to droop in your hands like a cornflake packet full of Meccano. The case, in short, is thin.

It is hard to know what to make of this. There is, of course, nothing pansy about those flimsy Japanese apartment blocks built to flex with the earthquake: they remain standing when the bricks and mortar around them have been reduced to rubble. While the Fujitsu is sitting on a work surface going about its lawful business the case is perfectly adequate. In fact the ABS-like plastic it is moulded from is surprisingly stong. But so, I'm afraid, is my prejudice against anything floppy not spinning in a disc drive.

Benchmark tests for standard and formatted text, tabbing and graphics.

Test	Time	Comments
Standard text	1min. 15s.	About 48cps. Certainly the fastest daisywheel printer we have tested to date
Formatted text	36s.	Motion minimisation is excellent
Tabbing	35s.	Good alignment, not quite up to Diablo standard
Graphics	4min. 5s.	Very fast for RS-232 interface



Bidirectional printing and motion minimisation are controlled by firmware. The print wheel carries an inner ring of characters.

Conclusions

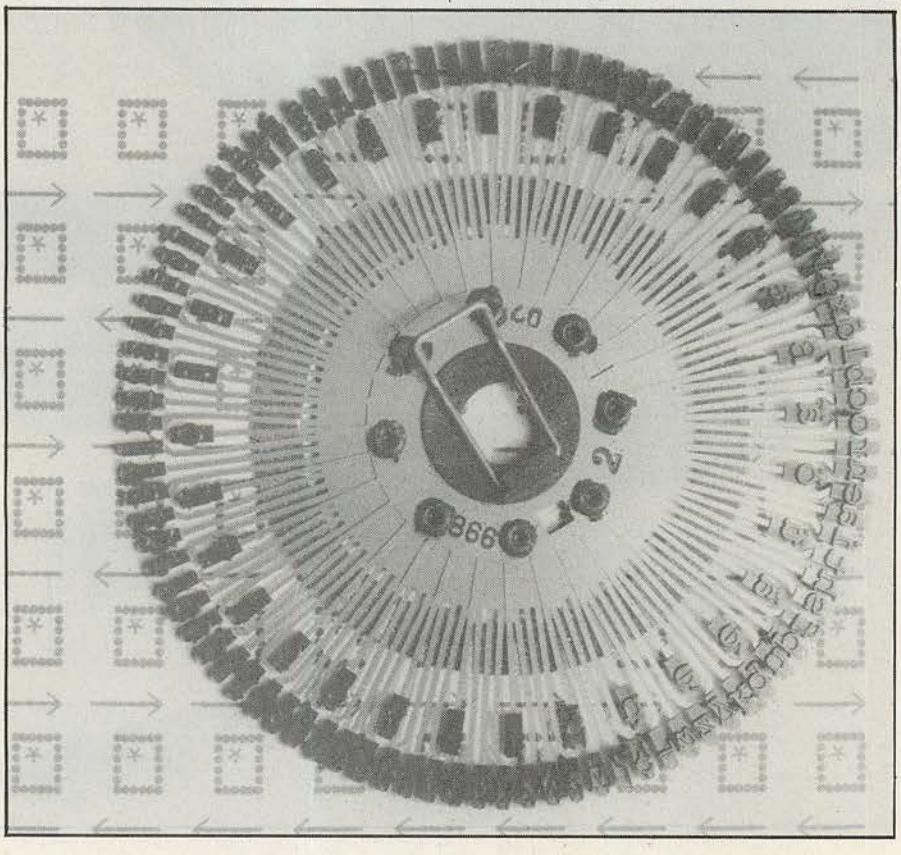
● The Fujitsu daisywheel printer is a fast, low-noise machine with a well-implemented helical drive to move the print head.

● This novel technology, for a daisywheel, is another step in the process of simplification of the moving parts and should result in fewer and less costly repairs.

● Firmware helps speed up the machine by bidirectional printing and motion minimisation.

● An "outer casing minimisation" exercise has also been carried out in production. The plastic material is tough but flexes dramatically when you carry the machine or lift the front cover. This in no way degrades the performance of the machine, in fact the manufacturer would probably argue that the money has been spent where it matters — on the print mechanism. But it certainly challenges one's British prejudice that if machine is worth building it should be built like a tank.

● The SP-830 costs £1,500 and is distributed in the U.K. by Zygal Dynamics, Zygal House, Telford Road, Bicester, Oxfordshire OX6 0XB. Telephone: (08692)3361.



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Computing on the train

Ian Stobie tests Sony's Typecorder, a portable text processor, and looks ahead to a forthcoming word-processing package running on the Epson HX-20.

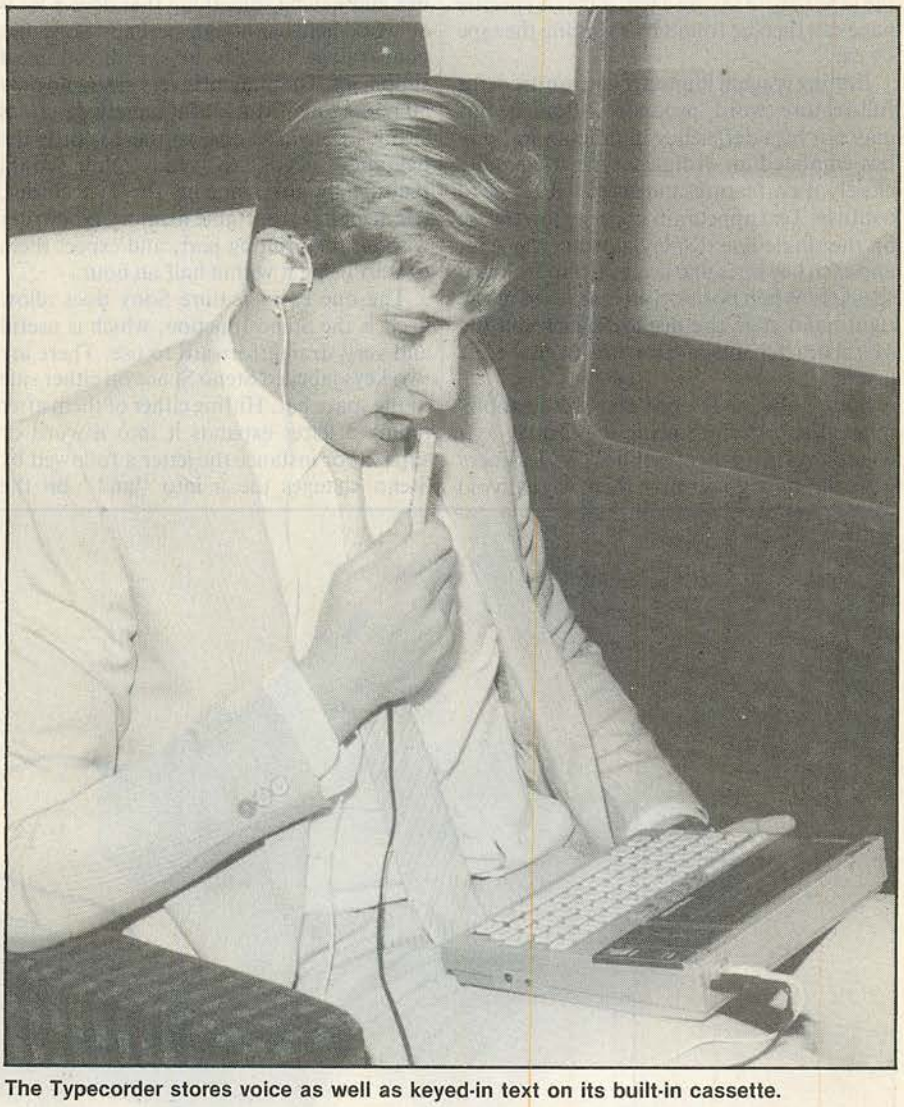
THE SONY TYPECORDER is a simple but nonetheless useful machine. It combines the functions of a dictation machine and word processor into a single portable package for use either just with a printer or linked into a larger office-wide system.

The basic Typecorder itself weighs just over 3lb. and has a full typewriter-style keyboard with a good touch-typing feel and a single-line 40-character upper- and lower-case LCD display. It is as compact as the full-sized typewriter keyboard layout allows, and an A4 sheet of paper will cover it completely. Four AA-sized batteries or their NiCad equivalent provide for about 5 hours of heavy use. It is, as claimed, a practical portable machine.

Sony avoids explicit reference to word-processing in its literature and has kept the whole thing deliberately simple. Nonetheless, being a regular user of word-processing kit, at first I did not like the Sony Typecorder. It is not very sophisticated compared to most of the word-processing packages that run on general-purpose microcomputers, and I found the editing features it offers too limiting. Sony provided a U.S. model for review and in the couple of months I had it I came to find the machine very useful.

What first changed my initial impression were the tape-recording functions of the machine. The Typecorder uses a built-in microcassette drive to hold both stored text and voice, and can be used like a conventional dictation machine. The equivalent of about 50 pages of A4 single-spaced text fits on each side of a C60 cassette or, obviously, about 30 minutes of speech.

The Typecorder comes with a neat microphone/controller and an earphone, and has a built-in speaker. You can record notes on a tape and subsequently type them into the Typecorder, which is more spontaneous than using a separate recorder and having to take it into the large, crate-like Research Machines 380-Z on which we normally run WordStar. However, for a finished article WordStar still scores as the Typecorder has severe limitations as a word processor.



The Typecorder stores voice as well as keyed-in text on its built-in cassette.

The Typecorder comes with 2K of RAM — not very much by the standard even of a modern home computer. Sony does not say what CPU is used, and the machine is not user programmable in any way. The functions it comes with are the functions you get. Some 1,800 characters of the 2K memory space are available to the user for text storage, allowing about one A4 single-spaced page to be dealt with at a time.

To use the Typecorder you switch on and start typing. After typing a page's worth you save it on to tape, which takes about 35 seconds and wipes memory, and then continue with the next page. Everything proceeds strictly on a page-by-page basis, so to edit an earlier page you have to load it

(continued on next page)

Computing on the train

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back into memory. The contents of memory are lost when the machine is turned off. Half-finished pages must be stored on tape at the end of a session.

There is no provision for saving named files — you have to keep track of what you have placed where yourself. The current tape position can be displayed on the LCD by holding down the Code key and typing S, but this helps no more than a conventional tape counter would. In a short document written sequentially this is not much of a problem, but it is still useful to record a name and date using the microphone on to the tape before saving a text page. A specific page can then be found by scanning the tape by ear.

Editing is again limited if you are used to a full-feature word processor, though this may not be a deficiency in practice as Sony has emulated an ordinary typewriter quite closely. Few features means few features to confuse. Text appears in upper or lower case on the single-line display as you type it in, and each key hit is marked by a blip from the speaker. When position 40 is reached at the right-hand edge the display clears and the 41st character appears, starting from the left again.

Sony obviously prefers this simple-minded approach to using the display as a window on to a wider text line. The designers generally have gone out of their way to avoid alarming users with the wonders of technology, even when a wonder or two would really be quite welcome. Character delete and insert functions are provided on function keys, along with backward and forward scrolling, one 40-character line at a time.

There is no find and replace facility and no block move or other block operations, but they would not be found on a typewriter either and within the limits of a single A4 page you would hardly need them. Left and right margins can be set, the maximum line width being 80 characters, but paragraphs cannot be reformatted once typed in. Page size is restricted to 66 lines or 1,800 characters, whichever occurs first.

Although its limitations are all too obvious, the machine is still useful. The well-known trade-off in the computer world between having something that is easy to use and having something that does a lot is at work here, although perhaps Sony has gone rather too far in the direction of simplicity. The manual is very clear and only 50 pages long. Much of it merely describes various Sony add-ons, so there is little the beginner needs to read. You could realistically give someone the Typecorder, tell them it is a portable memory typewriter without the printing part, and expect them to start using it within half an hour.

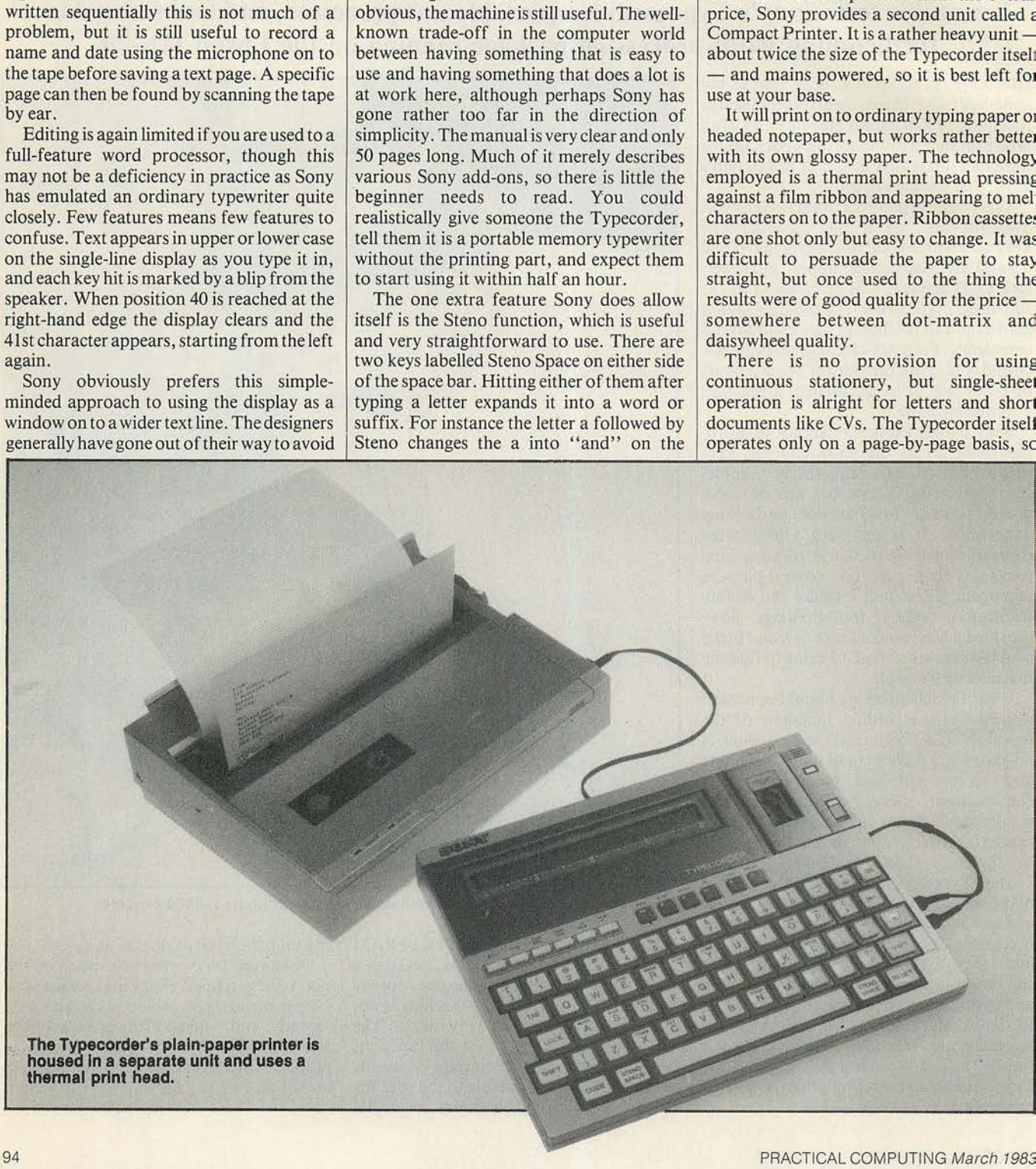
The one extra feature Sony does allow itself is the Steno function, which is useful and very straightforward to use. There are two keys labelled Steno Space on either side of the space bar. Hitting either of them after typing a letter expands it into a word or suffix. For instance the letter a followed by Steno changes the a into "and" on the display, be becomes "been", c "can", and so on.

If the letter is at the end of a string o characters the Typecorder will generate suffixes automatically. For instance if you type in "capa" and hit the Steno key i expands to "capable", b as in "capab" becomes "capability" and c as in "glac" becomes "glacial". Steno will also expand symbols to the equivalent word, so % becomes "percent", 0 becomes "zero", 1 becomes "one". The character strings Steno associates with each key are not user definable but fixed so this glossary feature is limited, but it is nonetheless a useful frill.

Having used the Typecorder for text entry and for recording speech, the next thing you will want to do is print. Within the overall price, Sony provides a second unit called a Compact Printer. It is a rather heavy unit — about twice the size of the Typecorder itself — and mains powered, so it is best left for use at your base.

It will print on to ordinary typing paper or headed notepaper, but works rather better with its own glossy paper. The technology employed is a thermal print head pressing against a film ribbon and appearing to melt characters on to the paper. Ribbon cassettes are one shot only but easy to change. It was difficult to persuade the paper to stay straight, but once used to the thing the results were of good quality for the price — somewhere between dot-matrix and daisywheel quality.

There is no provision for using continuous stationery, but single-sheet operation is alright for letters and short documents like CVs. The Typecorder itself operates only on a page-by-page basis, so



The Typecorder's plain-paper printer is housed in a separate unit and uses a thermal print head.

each page of a long document has to be loaded into memory from tape, a process that takes about 30 seconds before it can be printed. Neither the printer nor the Typecorder itself is very suitable for longer documents. This article, for instance, extends in typescript to 15 double-spaced pages and is beyond the Typecorder's useful scope.

Sony provides other output options, including a communications/printer interface box, which has a Qume-compatible parallel and an RS-232C interface, fitting most dot-matrix and daisywheel printers. A number of other add-ons are available in the United States. The slightly comical electric typewriter actuator fits over the keyboard of an IBM-style typewriter and uses solenoids to thump the keys. There is also a paper-tape punch and an acoustic coupler available in the States.

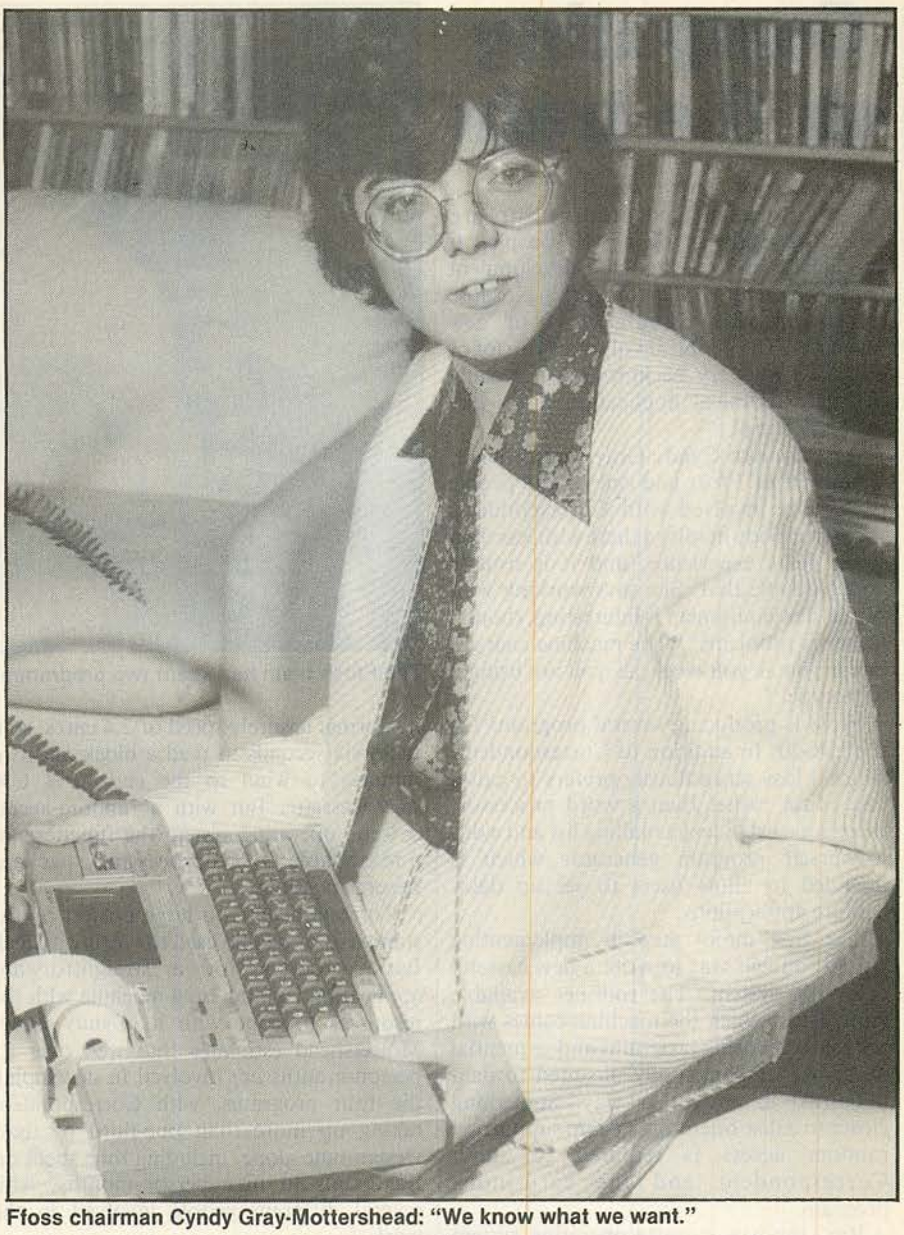
More important for Sony's prospects in the large company fleet-sales market is the ability to transfer Typecorder files to larger Sony Series 25 word processors. This permits the Typecorder to become the portable part of an office-wide system, not just a stand-alone unit for personal use.

Is the Sony worth buying? If you want the recording facilities or plan to link to other word processors in the Sony range, the answer is yes. As a stand-alone device it is neat and simple, especially for the computer innocent. The more sophisticated *Practical Computing* reader buying out of his or her own pocket might prefer a more flexible and programmable machine.

By the time Sony starts selling in the U.K. there may be more machines with portable word-processing capacity to choose from, apart from the heavier and more expensive machines in the Osborne I class. The word-processing package being written for the Epson HX-20 will make an interesting comparison with the Typecorder. Several more expensive machines intended primarily for portable word-processing use, like the Teleram, may make it across the Atlantic this year.

The Sony does not look like being alone in this market. It is very simple, but if this is what you want or perhaps need, then as an aid to personal productivity I think the Typecorder probably does work.

Because of changes in requirement for portable terminals Sony will be probably making significant improvements to the Typecorder before it is introduced into the U.K. According to Kevin Melia, U.K. spokesman for Sony Communications System Division, redesign will result in a machine which will be both cheaper and more capable.



Ffoss chairman Cyndy Gray-Mottershead: "We know what we want."

The Sony Typecorder is not ambitious in terms of the word-processing features it offers the user. But software has to be designed to fit the constraints imposed by the hardware it will run on. How do you fit word processing of any kind on to a small portable machine, without discs and with limited memory? Ffoss Ltd, a software house based near Maidenhead, is currently writing a word processor to run on the portable Epson HX-20, providing an interesting example of what is involved.

The design problem is determined by the environment. The standard Epson comes with 16K of RAM, around 13.5K of which is available to the user. It has a built-in microcassette drive, capable of holding about 100K to 120K on a C30 cassette, and a built-in 24-column printer, although for word-processing use it would probably be connected to a full-size printer like the Epson MX-80. Text is displayed on the HX-20's built-in 20-character by a four-line liquid crystal display.

Ffoss has decided to use the Epson expansion unit to make a little more elbow room. It costs about £80, so it will not add too much to the cost of a reasonably good word processor which people might be prepared to spend up to £200 for if it works. The expansion unit provides another 32K of memory, which can be divided up in various ways between RAM and ROM. Ffoss has opted for 24K ROM for the code and 8K RAM. Together with the 13.5K in the main unit Ffoss has a reasonable amount of memory to play with, provided the designers know what they are doing.

(continued on next page)

Typecorder specification

Manufacturer: Sony
Where made: Japan
Description: portable word-processing and dictation machine with matching printer
Size: 280 x 216 x 44mm.
Weight: 1.4kg.
Batteries: four AA or equivalent, giving about 5 hours continuous use
Power: 6V DC; AC adaptor provided
Display: single-line 40-character liquid crystal, 160 by 14mm.
Keyboard: full-size QWERTY layout, with six function keys and six tape-control keys
Price: probably around £750 for system comprising Typecorder with 2K RAM, built-in microcassette drive, rechargeable batteries and AC power adaptor, and separate A4 plain-paper Sony Compact Printer

Computing on the train

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Ffoss is a small, independent software house currently involving 10 people. It specialises in research-and-development work, which often calls for working in close association with manufacturers of new machines. The people involved have a lot of computer-industry background, especially in fairly technical application areas like process control.

According to Cyndy Gray-Mottershead, Chairman of Ffoss and one of the people principally involved with Correspondent, there is nobody involved there with less than seven years experience, and it is usually about double that. She says working with brand-new equipment is interesting, though it has its problems: "The machine changes under you as you work, as you are using a prototype."

Ffoss is producing several programs for the HX-20. In addition to Correspondent, which Ffoss scrupulously prefers to call a text editor rather than a word processor, there is a card index, a mailing list and a do-it-yourself program generator which is intended to allow users to set up data-capture applications.

The first major step in implementing Correspondent was to write a new cassette operating system. The routines available from Basic which the machine comes with are fine for storing programs and sequential data, but fundamentally ill-suited to data organised in any other way. Something closer to a disc operating system supporting random access is required for both Correspondent and the card-index program.

Rax, the new cassette operating system written by Ffoss, takes up 6K of the available space. It works by formatting the tape into blocks of 256 bytes and setting up a series of directories to keep track of where a particular named file physically resides on the tape.

The layout of blocks on the tape is not straightforward. There is a series of directories, and Rax is more complex than the typical small microcomputer disc operating system. According to Cyndy Gray-Mottershead, the magnetic recording surface of tape is not as well-behaved as disc blocks tend to move around as the tape stretches. In practice Ffoss has had considerable problems to cope with, and has had to delve into the depth of the hardware to implement Rax.

Rax allows the user to forget about how the tape is organised and to operate simply with named documents. Documents can be named, renamed and deleted, altered in size and copied into other documents, all of which would be impossible with the standard cassette operating system.

Using tape is still slow. The tape travels at its normal leisurely speed of 2.4 cm/s. so it takes six seconds to read a block and two minutes to wind to the end of a C30 microcassette. But with a random-access cassette operating system the functions of a reasonable word-processing package become possible.

The Ffoss team has spent two programmer-years developing software for the HX-20.

Correspondent is a large project by the standards of people used to writing a quick Basic program for a straightforward application running on a machine with the resources to cope with it. Cyndy Gray-Mottershead estimates that well over 25 person-months are involved in developing the four programs, with Correspondent taking up more than one-third of that. Design time alone, including time spent on Rax, runs to nine person-months, with several different people involved in the work.

This development time is being expended principally to save memory. Everything is written in assembler, which takes longer to write but allows you to optimise for space. The 6301 CMOS processor chip used in the HX-20 has a very similar instruction set to the Motorola 6800, and Ffoss has written modifications to a 6800 assembler. Development is done on a larger disc-based system, and once the code is assembled it is downloaded to the HX-20 for testing.

All space available on the machine is grabbed by Correspondent. The HX-20 has five variable-sized program areas, allowing up to five applications to be held in memory simultaneously. But they must be saved to tape before running Correspondent, which needs all the space itself. With a word processor you want as much of the document as possible to be in RAM to avoid having to swap it backwards and forwards to your storage device; with a slow medium like tape it is even more important. Correspondent is able to store the equivalent of three A4 pages of text in the 12K work area.

Correspondent has the normal editing functions of inserting, deleting and moving text, together with the kind of search and replace, block move and copy operations found on reasonable word processors. The Epson HX-20 function keys are used to specify command scope, and the arrow keys move you around the document. The HX-20 20-character by four-line screen is at present treated as an 80-character line, not as a window into a larger virtual text area, although Ffoss is assessing both methods to see which users prefer.

The 24-column built-in printer is used as a preview printer for portable use. Initially Correspondent will work with the Epson MX-80 printer for full-size output, supporting all its facilities like condensed,underscore and double-strike printing. The printer is controlled by commands which are embedded in the text like WordStar dot commands, to specify things like page length and top and bottom margins.

Some features have not been finalised. Some provision to merge names and address from the mailing-list program into Correspondent documents is planned, but whether it will go as far as the ability to embed variables from the list files into the body of the text is not decided. As Cyndy Gray-Mottershead says: "We know what we want, what the user specification is. It's how much we can get into the machine."

Correspondent looks like being an interesting product, pushing a small portable computer like the HX-20 into new applications well beyond the super calculator range. Ffoss is a specialist in writing software, and the results of its efforts will be sold through Epson. But the scale of the effort involved in developing it demonstrates that portables are not toys. Writing programs for small machines is not simple — it can be more difficult than writing for big ones.

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BBC/Atom graphics digitiser

J C Flowers describes an interface to enter graphics data, which you can build yourself without breaking the bank.

THERE ARE ONLY TWO cheap and easy ways of providing digital x,y co-ordinate information to a computer. The first technique is to use a light-pen, which operates by detecting where the position of the CRT raster, or scanning spot, when the photo-detector in the pen is illuminated. The x,y cordinate positions are latched inside the computer at this moment. Cheap light-pens will not resolve very small pixels, so only relatively coarse plotting can be achieved, and drawing has to be in freehand on the tube face.

The second technique uses some kind of potentiometer to obtain a reference to a particular position of a point on a map or drawing. A very simple x,y plotting tablet can be made using two orthogonally mounted slider potentiometers with Perspex cursors fixed to the slides, as shown in figure 1.

If linear potentiometers are used, the x,y co-ordinate positions are linearly related to potentiometer travel. I chose this method for the ultimate in cheapness and to develop the necessary circuitry. The tablet uses two 10K slider potentiometers, which cost £2 each, and gives a 5cm. square plotting area. The longer the slider travel, the bigger will be the plotting area, so buy the biggest pots you can afford.

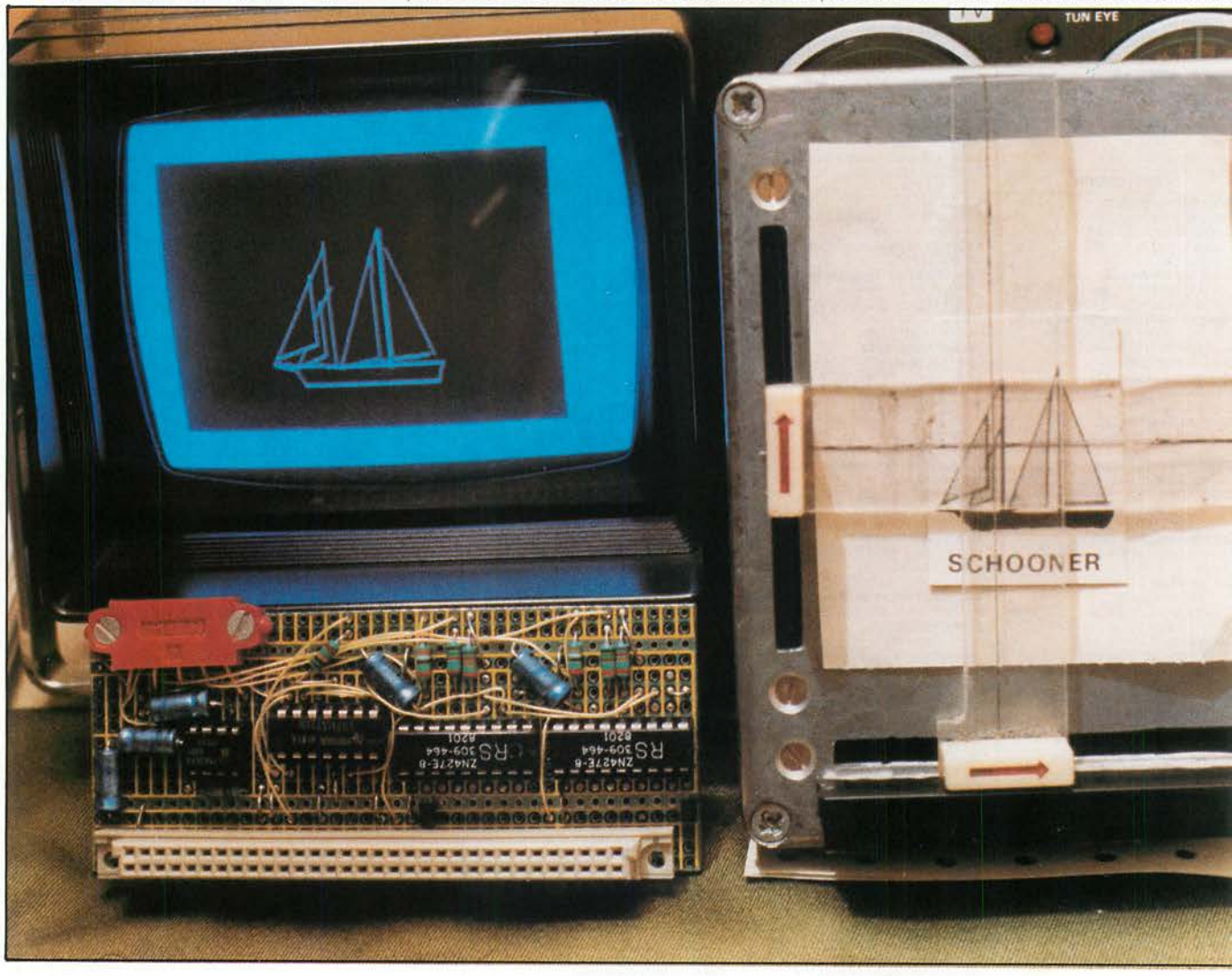
If you need a larger plotting or digitising area try the moving-arm x,y digitiser, which can be built to handle whatever size drawing you may wish to digitise. It consists of two equal-length pieces of wood or metal potentiometer shafts — see figure 2. The size of the platen or plotting area is determined by the length of the arm, which must be able to cover its area.

Provided linear pots are used there is a linear resistance-versus-angle law for each potentiometer. The actual x,y co-ordinate values have to be calculated by the computer using rectangular-to-polar conversion, where

$x = R\cos(\theta - \alpha) - R\cos\alpha$

$y = R\sin(\theta - \alpha) + R\sin\alpha$

The full travel of each potentiometer is not used to cover the platen, so the maximum and minimum resistance values have to be



determined experimentally. Appropriate scaling is applied before determining the angle from the resistance or resultant voltage value.

Most microprocessors do not measure resistance values but rather the resulting voltage on the potentiometer slider terminal when the potentiometer is connected across a fixed voltage source. To do this it is necessary to convert the variable voltage output to a digital number using an analogue-to-digital converter.

Many microcomputers already have A-D converters fitted as standard; if you have BBC Micro model B you will be able to connect the potentiometer outputs from the graphics digitiser directly to the analogue input port where up to four channels are available.

If you have a purely digital I/O capability, using perhaps a VIA or PIA chip such as the 6522 as used on the Acorn Atom, you will have to construct your own dual eight-bit A-D converter. The circuit shown in figure 3 gives good performance when coupled to a joystick controller, and is even fast enough to digitise speech. The design can be built for about £25, which compares favourably with commercial offerings. The circuit diagram has been drawn to show precisely how pins on the integrated circuits are wired, looking down on the ICs.

The A-D converter will plug directly into the Acorn Atom bus connector if constructed on a small piece of Verocard or similar prototyping material. The numbered pins refer to what you will find printed on a 64-way mating DIN connector, not what is printed on the Atom's circuit diagram which for some reason has the a and b pins reversed. The ICL-7660 is used to generate −5V from the Atom's +5V supply; this is required by the A-D converter chips so that they can keep digitising down to zero volts on their input.

The 74LS73 device is a dual JK flip-flop which is connected so as to divide the Atom's 1MHz microprocessor clock down to 250kHz so it provides the clock signal and correct start timing for the Ferranti ZN427E eight-bit A-D converter devices. The ZN427E is a successive-approximation A-D converter and contains a D-A converter, voltage comparator and successive-approximation register.

When it is asked to make a conversion by pulsing pin 4 low, the ZN427E internally toggles each of its eight bits starting with the most significant bit and sees if the resulting answer from its internal D-A converter, when compared to the incoming analogue signal, is bigger or smaller. It sets all its eight bits finally to equal numerically the incoming signal and then signals it is ready by taking pin 7 high, at the same time placing the data on the bus where the Atom can read it as it appears on the 6522 VIA input pins.

This process is quite fast, and with the

(continued on page 103)

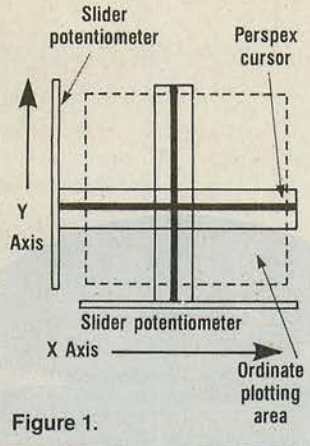


Figure 1.

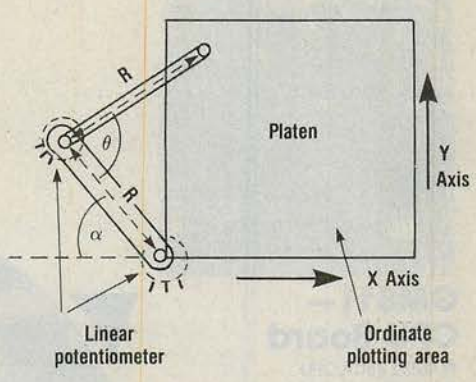
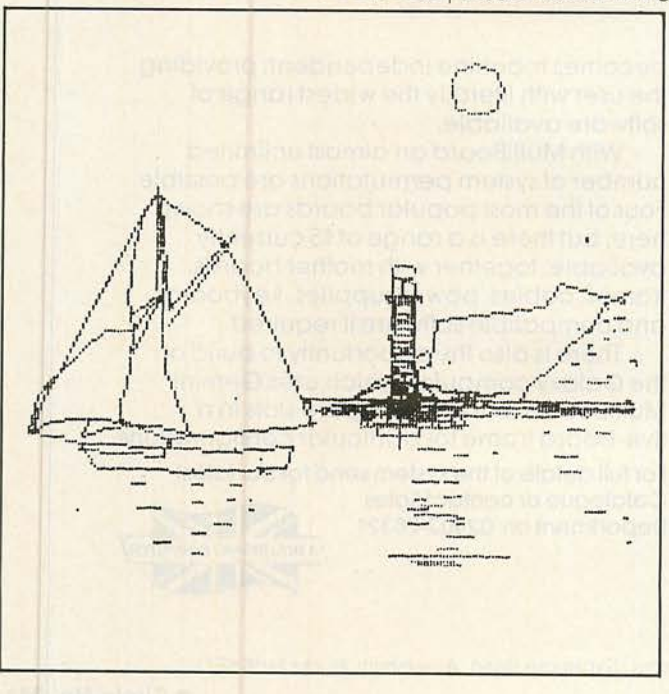
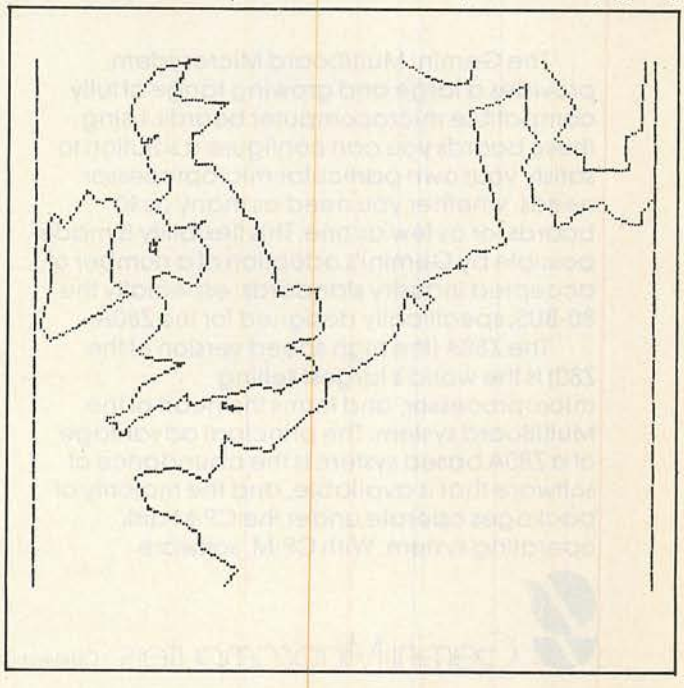


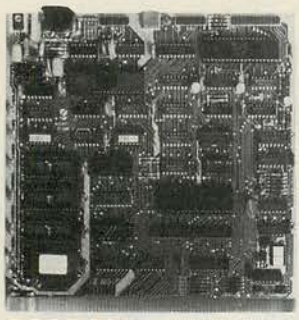
Figure 2.

	Quantity	Radiospares stock number	Description
ICL 7660	1	304-598	voltage generator
74LS373	1	305-125	dual JK flip-flop
ZN427E	2	309-464	A-D converter
10K slider pot	1	162-940	
82K resistor	2		
3.9K resistor	2		
390 ohm resistor	2		
10μF capacitor	5		
0.01μF capacitor	2		
64-way DIN euroconnector socket	1	467-475	
Verocard	to suit		

A-D converter parts list.





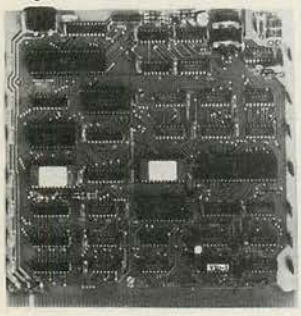


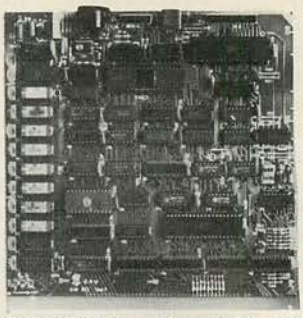
GM811 – CPU Board

* 4MHz Z80A CPU
* Four 'Bytewide' Memory Sockets
* Two 8-Bit Input/Output Ports
* 8 Bit Input Port
* RS232 Serial Interface
* 1200 Baud CUTS Cassette Interface

GM812 – IVC Board

* 80x25 Display Format
* On-board Z80A Microprocessor
* Buffered Keyboard Input
* Programmable Character Generator
* 160x75 Pixel Graphics
* Light Pen Input





GM813 – CPU/64K RAM Board

* 4 MHz Z80A CPU
* 64K Dynamic RAM
* RS232 Serial Interface
* Two 8-Bit I/O Ports
* 1200 Baud Cassette Interface
* Extended and Page Addressing Modes

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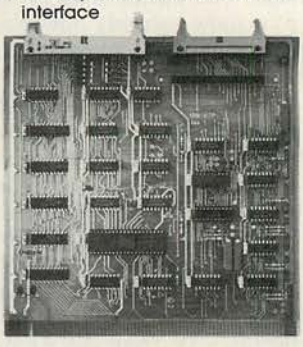
* Single/Double sided drive operation
* Up to 3 mixed 3.5", 5.25" and 8" drives
* Industry Standard SASI hard-disk interface



15 80-BUS SOLUTIONS

The Gemini Multiboard Microsystem provides a large and growing range of fully compatible microcomputer boards. Using these boards you can configure a solution to satisfy your own particular microprocessor needs, whether you need as many as 10 boards, or as few as one. This flexibility is made possible by Gemini's adoption of a number of accepted industry standards; especially the 80-BUS, specifically designed for the Z80A.

The Z80A (the high speed version of the Z80) is the world's largest selling microprocessor, and forms the heart of the MultiBoard system. The principal advantage of a Z80A based system is the abundance of software that is available, and the majority of packages operate under the CP/M disk operating system. With CP/M, software becomes machine independent; providing the user with literally the widest range of software available.

With MultiBoard an almost unlimited number of system permutations are possible. Four of the most popular boards are shown here, but there is a range of 15 currently available; together with mother boards, frames, cables, power supplies, keyboards and compatible software if required.

There is also the opportunity to build on the Galaxy computer, which uses Gemini MultiBoards, but has two spare slots in a five-board frame for particular configurations.

For full details of the system send for our latest Catalogue or contact Sales Department on 02403-28321.

A MULTIBOARD COMPUTER

Gemini Microcomputers Oakfield Corner Sycamore Road Amersham Bucks HP6 5EQ

Circle No. 263

Graphics digitiser

(continued from page 101)

circuit as shown can take place at a 27kHz rate quite suitable, for instance, for digitising speech. The input to each converter is on pin 6 via a 3.9K resistor. If speech use is required, then set the x or y potentiometer to half way and connect the output of your amplifier via a large capacitor to the potentiometer slider terminal.

Otherwise, the x and y potentiometers of the chosen graphics digitiser are connected with one end to ground and the other to the ZN427E pins 7 and 8, which provide a 2.5V reference potential. If you make 0 and 255 the digital outputs of the converter at either end of the potentiometer travel you will not have to do any scaling in software.

When you are satisfied that your wiring is correct, plug the circuit into your Atom's bus connector. The current consumption will be about 80mA. The digitiser plotting program will enable plotting to commence, and can be used to test your circuit. The Rem statements explain the program. The two Conversion Complete signals at A21 and A12 should not normally have to be used in Basic but may be necessary for timing purposes if you write a machine-code program to use the system for speech processing.

Digitiser plotting program.

```
 4REM Plotter XY PLOTTING FACILITY.
 5?#208=#55:?#B802=#00:?#B803=#00
10 DIM LL(2),P(-1):L=#80:M=#82:?M=#00:A=#30
20 P.$21
30[
40:LL0 JSR #FFE3
50STA L
60RTS
62:LL1 JSR #FE71
64STY M:RTS
70]
75!A=#022D80A9:A!4=#4CF9D0B0
80P.$6:CLEAR4
85A!8=!#3FE:!#3FE=A
90LINK LL0
92IF ?L=#20 GOS.b:REM SPACE BAR PLOTS FROM LAST TO NEXT POINT
 94 IF ?L=#4D GOS.c:REM M MOVES FROM LAST TO NEXT POINT
 96IF ?L=#58 G.d:REM X MARKS ORDINATE POSITIONS.
 97REM TAP X AGAIN TO CANCEL MARKER
100G.90
120END
140b?#B80C=#CE:?#B80C=#CC:?#B80C=#CE:REM START CONVERSION
150WAIT:WAIT
160X=?#B800:Y=?#B801
170X=32+(X*192/255):Y=Y*192/255:REM SCALE FOR SQUARE PICTURE
175DRAWX,Y:F=X:U=Y:R.
180c?#B80C=#CE:?#B80C=#CC:?#B80C=#CE
190 WAIT:WAIT
200X=?#B800:Y=?#B801
210X=32+(X*192/255):Y=Y*192/255
220MOVEX,Y:F=X:U=Y:R.
230d?#B80C=#CE:?#B80C=#CC:?#B80C=#CE
235WAIT:WAIT
240X=?#B800:Y=?#B801
250X=32+(X*192/255):Y=Y*192/255
260MOVE(X-1),Y:PLOT5,(X+1),Y:MOVEX,(Y-1):PLOT5,X,(Y+1)
262WAIT
264MOVE(X-1),Y:PLOT7,(X+1),Y:MOVEX,(Y-1):PLOT7,X,(Y+1)
265WAIT:WAIT:WAIT:WAIT
266MOVEX,Y:LINK LL1
270IF ?M=#38 THEN MOVEF,U:G.90
280G.d
```

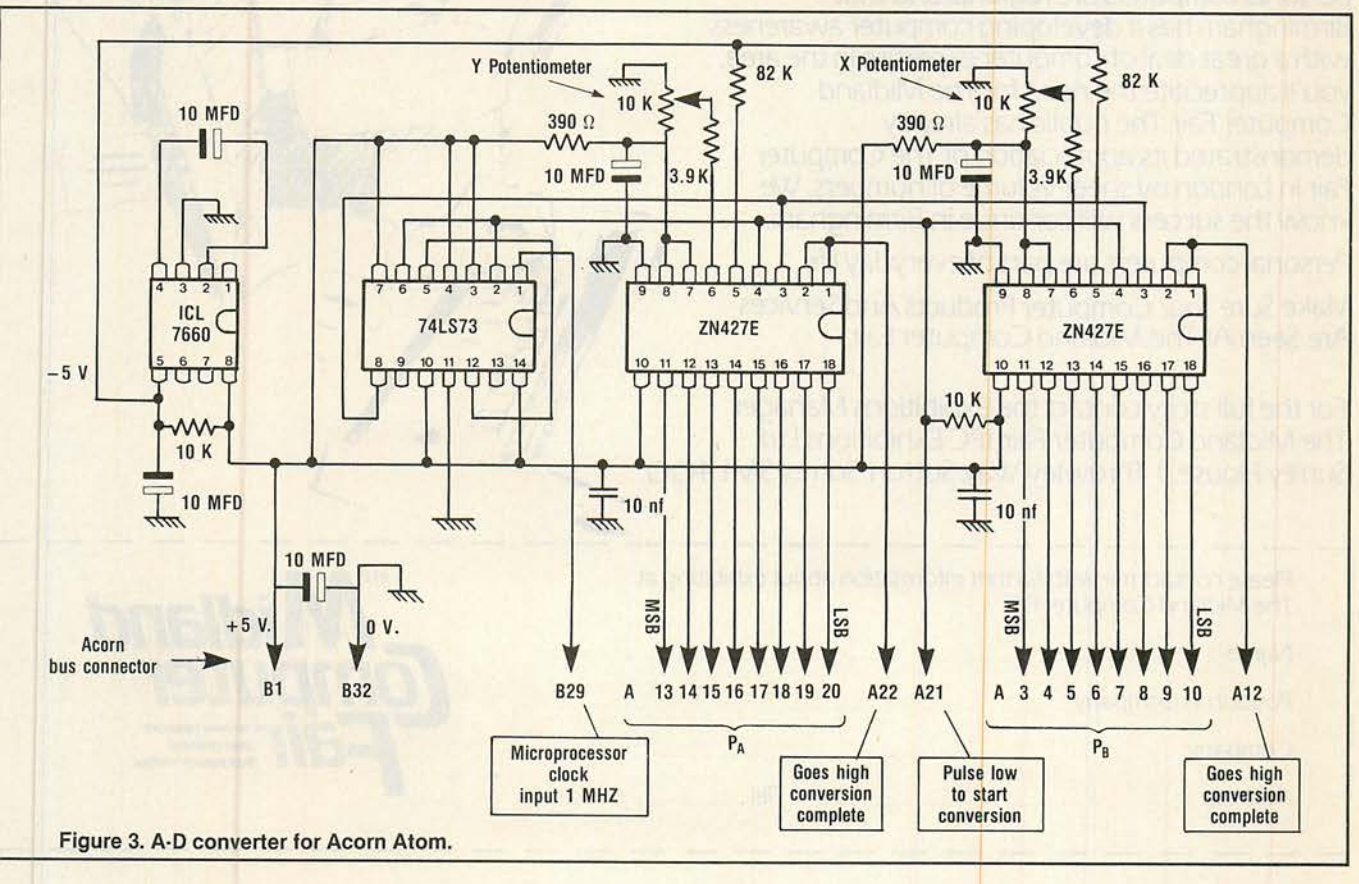


Figure 3. A-D converter for Acorn Atom.

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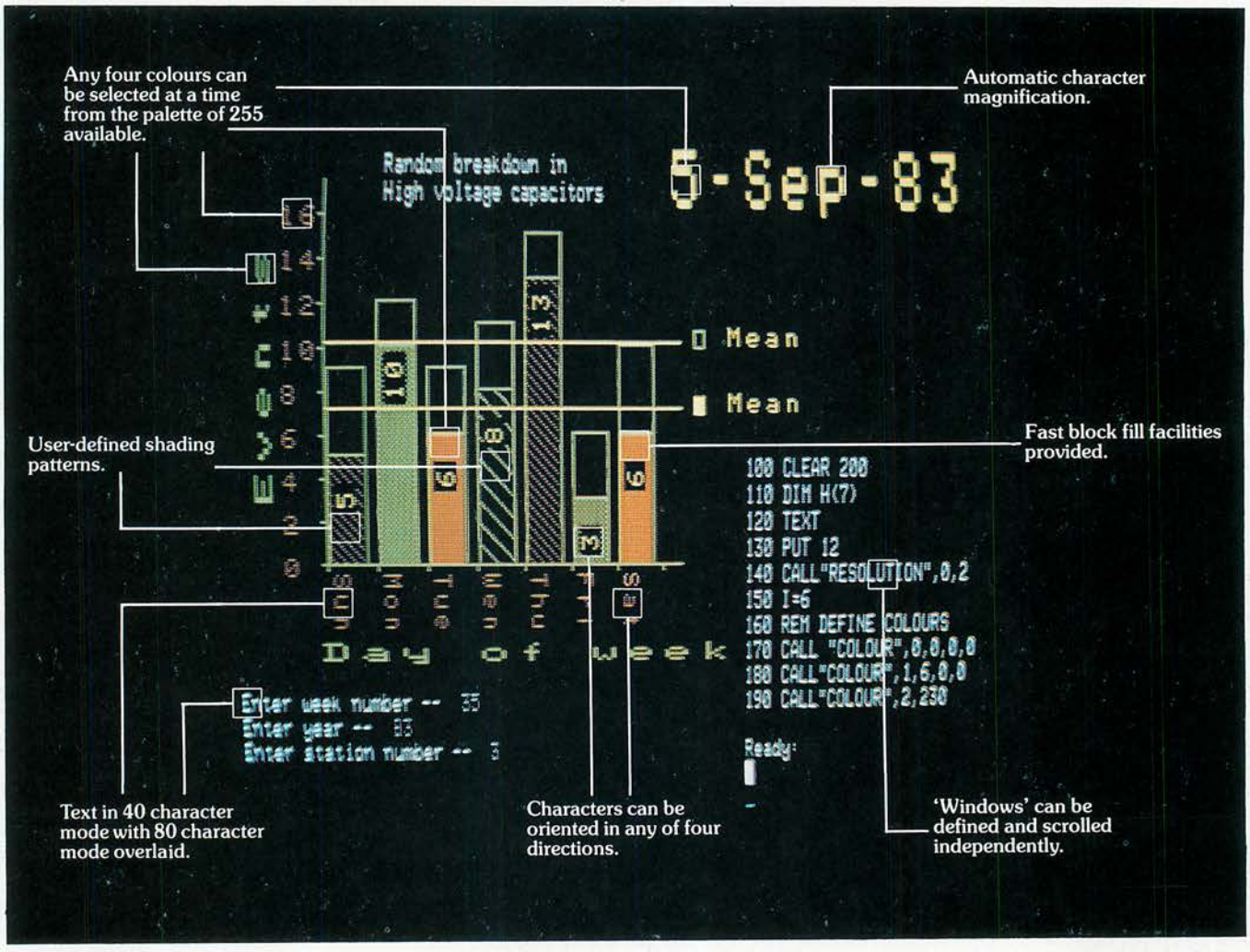
Any four colours can be selected at a time from the palette of 255 available.
Automatic character magnification.
Random breakdown in High voltage capacitors
5-Sep-83
0 Mean
Mean
User-defined shading patterns.
Fast block fill facilities provided.
100 CLEAR 200
110 DIM H(7)
120 TEXT
130 PUT 12
140 CALL"RESOLUTION",0,2
150 I=6
160 REM DEFINE COLOURS
170 CALL "COLOUR",0,0,0,0
180 CALL"COLOUR",1,6,0,0
190 CALL"COLOUR",2,230
Ready
Day of week
Enter week number -- 35
Enter year -- 83
Enter station number -- 3
Text in 40 character mode with 80 character mode overlaid.
Characters can be oriented in any of four directions.
'Windows' can be defined and scrolled independently.

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● Circle No. 18

Monday morning computing guide

Start the week off with Chris Naylor's A-Z guide and find out what the manual's instructions really mean.

Absolute address Read no further, this is the definition you want.

Acceptance testing A lengthy and time-consuming process in which the job specification is gradually and completely altered to match the equipment supplied.

Access time About 30 seconds, usually.

Accumulator A method of problem accretion initiated by an early attempt to solve one problem only by computer.

Accuracy A precise concept defined by the number of bits used in number storage: for example, 16-bit accuracy. The last bit is always wrong. Each operation on a number makes the next bit wrong also. After 16 operations the whole number is wrong. See also *Inaccuracy, Dump.*

Acronym A Completely Random Ordering Never Yields Meaning.

Address See Indirect Address.

Algol A variable star of the eclipsing type with a period of 69 hours.

Algorithm A series of instructions for solving a specific problem. Not to be confused with a program, which is just one realisation of these instructions implemented on a machine, other than the machine you have, for solving a specific problem unrelated to the particular problem you have, and which fails.

Alphameric The logical result of trying to say "alphanumeric" first thing in the morning.

Architecture The most impressive part of any computer system — the box it comes in.

Array A simple but powerful method of reducing available storage.

Assembler The language in which 10 percent of all programs must eventually be written.

Associative memory A system of memory hardware which is able to note that address x has a fault in it, and so that address x doesn't feel bad about it is able to reproduce this fault randomly throughout the entire system.

Babbage A British genius, born 1791, who invented computers and then discovered the First Law of Computers — they don't work.

Backing store A method of data storage, additional to main memory, which is designed to make the computer itself seem relatively cheap by comparison.

Basic The only high-level language which can be mastered completely in less time than any program written in it will take to execute.

Benchmark A precise method of measuring the ability of a computer to do something which nobody in their right mind would ever want it to do.

Binary A simple but powerful method of losing your data.

Bit The part of your program that is right.

Boolean See *Binary* or *Logic.*

Branch See *Boolean.*

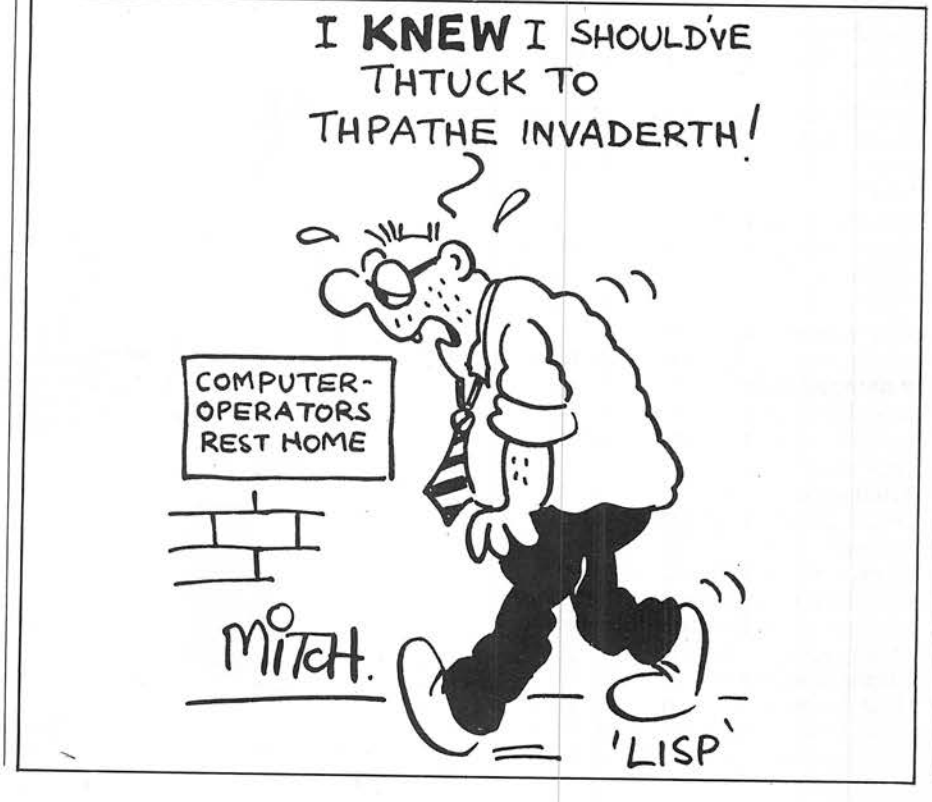
Bug A method of programming in which error messages are selectively arranged into simple words appropriate to the task in hand.

Byte Eight bits, only one of which is wrong.

Call A simple but powerful method of leaving the section of code from which you knew where you were to enter another section of code, of unknown location, thereby enabling the program to corrupt all variables and finally return control to a third section of code which actually appears to belong to another program altogether. See *Dump.*

Clock A mechanical device which mocks your computer by its reliability and speed.

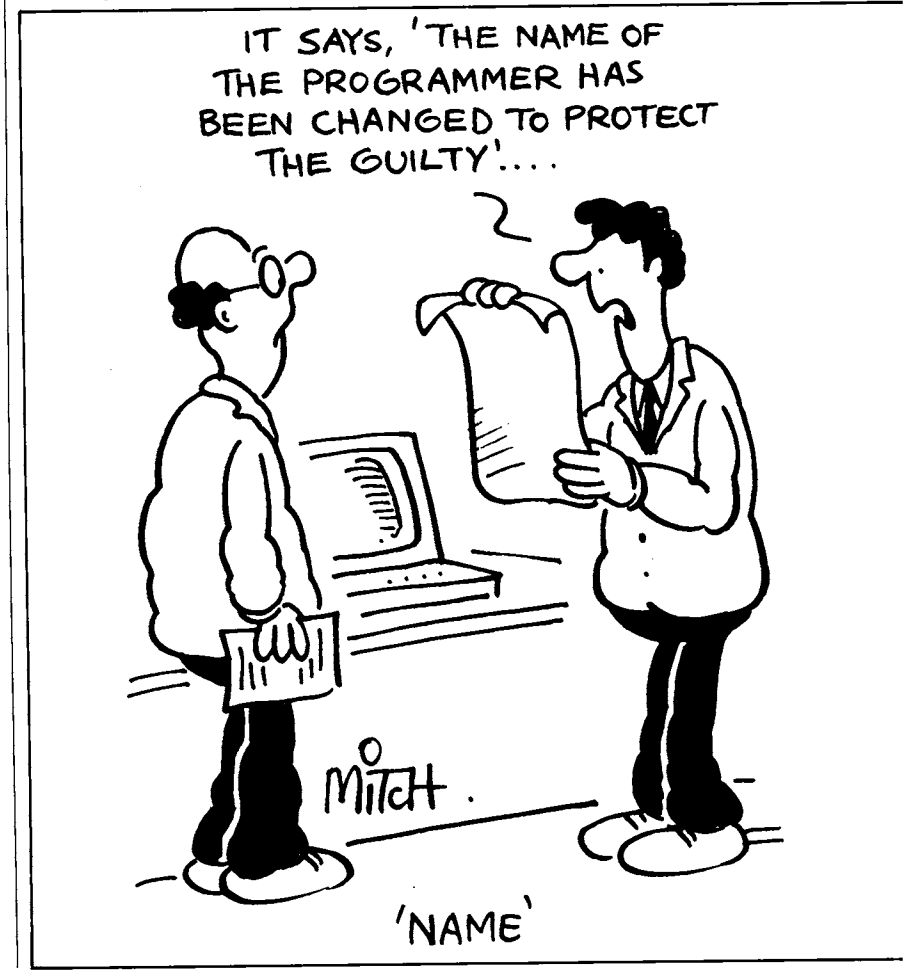
(continued on next page)



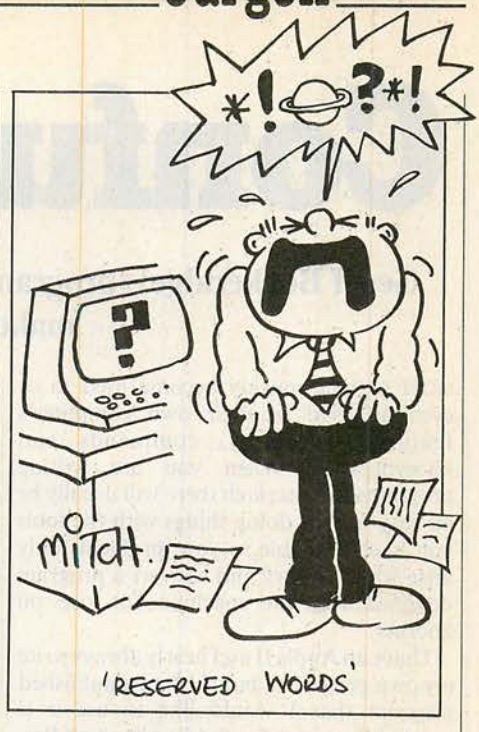
Monday morning computing guide

(continued from previous page)

Cobol A high-level language designed to enhance long-term employment prospects.
Compatible A theoretical concept. See *Incompatible.*
Compiler A program written specifically to treat a higher-level language program as data, reduce it to machine code in parts and rearrange these parts before giving up. See *Unsupportable.*
Conditional See *Iteration,* if you haven't seen it already.
Cumulative error See *Accuracy.* Then see it again.
Cursor A programmer against a deadline.
Cycle time The time a program takes to give you exactly the same errors you started off with.
Data A vital collection of variables which, when held in memory, leave no room for the program.
Database A vital collection of variables which could not conceivably be held in memory, whether there is a program there or not.
Database management system A program without which those vital variables could never be accessed and, with which, they will not fit in memory.
Data dictionary A method of describing data in such a way that you always know exactly how much of it has been lost.
Data manipulation A method of programming designed to make the data match the answers you know are right.
Data transmission A method of corrupting someone else's data from a safe distance.
Default An application for which the program might be useful. Not the intended application.
Direct access A method of reading or writing the wrong piece of data at high speed.
Dump A method of programming based on the assumption that there must be something useful in memory if only you can find it.
Editing See *Dump.*
Elliot A real computer manufacturer from the days when programmers were men who drove machines that were iron and a program patch meant Sellotape.
Emulate A program which behaves like another program by virtue of being a precise copy of it.
Encode To render permanently incoherent.
Encrypt To render permanently cryptic.
Enhance To encode or encrypt.
Entry point A point in the program to which the machine goes before you have had time to stop it going there.
Erase An attempt to read vital data of which you have no back-up copy.
Error A section of output that, momentarily, you are unable to justify.
Expert system A computer system that can replace the human expert by sitting on a desk, consuming electricity, and saying Illegal Command.
Fifth generation A method of program maintenance much worse even than usual. See *Maintenance.*
File An unstructured, undocumented, unreadable and interminable section of data produced by someone else's program, which will cause any part-way decent program to crash instantaneously on catching mere sight of the file header.
Floating point A system of number representation based on the assumption that you know the answer already.
Fortran A traditional high-level language designed to enable scientists to corrupt the system without having to call in outside help.
Function A standard section of code, inaccessible from outside itself, which reduces the amount of memory available to the rest of the program.
Global A fault which permeates the whole system.
Goto A method of leaving the current section of code with no means of ever returning, in order to enter a further section of code which, you now recall, has not yet been written. See *Dump.*
Hard copy Evidence. The main reason for using VDU screens.
Hardware That part of a computer which never fails and is, therefore, unable to do anything useful by itself.
Hexadecimal A simple but powerful method of concealing your activities.
High-level language A programming language which allows you to express powerful statements in an unexecutable fashion.
If A general class of wish-fulfillment statements.
Incompatible The main argument in an expression designed to obtain a hardware upgrade.
Indirect address See *Address.*
Initialise. A method of damage control used at the end of each program run.
Interpreter A slow Compiler; see *Compiler.*



Iteration See *Iteration.*
Label An identifier used to mark a section of code for access from another section of code by means of a Goto or a Jump or a Call, subject to the condition that each label must occur at least twice or not occur at all or be a system label.
Library A collection of subroutines designed to enhance the length of a program without influencing its operation.
Lisp A highish-level language designed to weaken both the distinction between program and data and the programmer's grip on reality.
Literal A simple but powerful method of writing the answer in by hand.
Local A subroutine without entry or exit points.
Logic A formal and powerful method of explaining why the program doesn't work.
Loop See *Iteration* and *Loop.*
Machine code The language you should have learned.
Macro A machine-code subroutine designed to save the programmer the inconvenience of having to corrupt large areas of store by hand.
Maintenance A programming method in which development work is carried out by the programmer's children and their children's children.
Matrix A method of mathematical notation which bears strong but insufficient resemblance to arrays.
Memory A free-fire zone for both programs and data. A no-go area.
Mnemonic Something whose precise use one forgets.
Name The identifier by which a variable, but not this variable, is known.
Null A formal expression for the value of a system.
Number cruncher This is too horrible to describe in what is, after all, a family journal.
Operating system A master program which, alone, can destroy all lesser programs.
Own A method of ensuring that a local variable remains local; see *Unsupported.*
Parameters The actual values of some variables which define an operation. An n parameter operation always has n – r parameters defined, where r is a random number.
Parity A state of equivalence in which neither you nor the computer know the answer and so you toss for it.
Password A system of computer security in which a secret number is assigned to each user and then written out in a list and left by the console in case anyone forgets their particular number.
Peek See *Dump.*
Poke A sophisticated method of dump-modification.
Pointer A sort of dog which always seems to know which way the data went.
Pop up, push down a frustrating condition which will not go away.
Polish notation An algebraic notation in which all of the numbers are entered first, thus making it impossible to tell where one number ends and another one begins. See *Dump.*
Portable A uniform method of programming so that a program developed on one machine may be run on any other machine with exactly the same result. The result is that it does not work on any machine.
Prefix A method of arranging a demonstration so that, just this once, the program works.
Proprietary software A program whose ownership is certain but whose purpose is not.
Prototype A program which does not work perfectly but is still better than the program you eventually get.
Quotes A method of denoting key words in some languages and string expressions in others. Quotes always occur n + 1 times where n is an even number.
Recursion A subroutine which can be entered from within itself or from outside itself but not from any other point, and which may not be exited while the initial condition holds, or while any other condition holds unless there is a note in the manual to the contrary.
Redundancy A means of encoding data such that, when corrupted, it is possible to reconstruct the original form of the data inexactly from other data elements, which might well have been corrupted also for all you know. Communications experts have now developed algorithms which can carry out redundancy checks on data almost as fast as it comes in.
Reserved words The first choice for variable names.
Reverse Polish notation A method of price justification for expensive calculators.
Seek time The time it takes to read from disc a piece of data which isn't there.
Sort The arrangement of items in an order with respect to some variable, but not the variable or the items you originally had in mind. A method of scrambling the contents of a disc. See *Encode, Dump.*
Spec An unreasonable request.
Stack A large number of unreasonable requests.
Storage An area of memory, either main or peripheral, which is insufficient for any reasonable needs.
String A small section of code which makes sense but is unexecutable.
Structured A method of programming which makes the unreasonable request that you should know what you wish to program before you start to program it. More usually: a method of describing a program by reference to something it happens to do.



Subroutine A section of code which should have been written earlier.
Suite A single program which will not fit into main memory.
Symbolic The specification of the machine you bought.
System disc A general-purpose storage area for programs and data.
Table A method of writing in a large number of answers by hand.
Test data A collection of variable values consisting of all those values for which the program will work.
Turnkey A special-purpose computer which, at the turn of a key, reveals its purpose to be other than that for which you bought it.
Type The data format of a variable. Type is always Real.
Unsupported A class of features without which any given system is useless.
Utility A program which is widely available yet useless.
Variable The contents of a location in memory which can be accessed by means of two or more variable names.
Verification A method of program checking which is known not to reveal any errors.
Write protection A mechanical method of physically preventing a program from writing to a tape or disc containing valuable data which your program nas just overwritten due to omission of this precaution.
X Marks the spot in the dump where you last saw your program.
Yarn A complex and subtle explanation of great length which demonstrates why it is logically impossible for the system to be working yet.
Zero Division by: not again, surely .....

Confuse-an-Apple

Geoff Buckeridge's program lets you run Pet programs on an Apple without having to make a laborious line-by-line conversion.

MOST PEOPLE quickly become used to or even attached to their own computer's features, functions, commands and idiosyncrasies. When you are writing programs from scratch there will usually be an easy way of doing things with the tools you have available to you; problems only arise when you try and convert a program designed for one machine for use on another.

I have an Apple II and nearly always write my own programs, but if I find a published program that I would like to use it is invariably written for the Commodore Pet. In this case it is necessary to convert the program before it can be keyed into your system, which can often be a time-consuming and even daunting task.

Faced recently with a mammoth conversion job, I wondered whether instead of tackling it manually my time would be better occupied in devising an automatic conversion program which could be used for similar occasions in the future. My first step was to decide which features I would most like to have on my Apple. Once implemented they would provide my system with an immense increase in flexibility and eliminate the need for conversion. The features are:

- The ability to incorporate cursor-control and screen-format characters within Print statements. The alternative Apple solution is messy, to say the least.
- A consecutive screen memory map and the ability to access these locations through Peek and Poke at the same memory addresses used by the Pet. The Apple screen map is far from logical.

The resultant program allows Apple users to type in Pet listings with a minimum number of modifications and even those can be done mentally so there should be no need to make intermediate notes. It can be split into three main sections: cursor-control conversion, screen Poke conversion and screen Peek conversion.

The Pet allows eight special control characters to be incorporated in Print statements. They are either graphic or inverse characters, which makes the listing untidy. Confuse-an-Apple allows you to enter a row of cursor-control characters starting and ending with a^.

For example,

```
PRINT "[CLS] [15 CR] [12 CD] [REV] hello
  [OFF]"
```

converts to:

```
PRINT
  "^CRRRRRRRRRRRRRRDDDDDDDD--
  DDDDI^ hello^N^"
```

The special characters are:

U — cursor up
D — cursor down
R — cursor right
L — cursor left
I — Inverse Print mode
F — Flash Print mode
N — Normal Print mode
H — cursor to top left of screen
C — clear whole screen and cursor to top left
E — clear screen from cursor to end of line
S — clear screen from cursor to end of screen
B — ring bell

The screen-Poke conversion part of the program allows you to Poke the same memory locations as if you were using the Pet, so there is no need to recalculate memory addresses. The only problem is that the Apple has 24 screen lines and the Pet has 25. Any attempt to Poke an address in the 25th line will result in an Illegal Quantity error at run time.

For example,

```
POKE 33000,130
```

converts to:

```
&POKE 33000,130
```

Expressions and variables can be used freely within the range 32,768 to 33,727.

The same rules apply for Peek as for Poke. As long as you avoid the 25th line there will be no problem. For example,

```
Y = PEEK (X/2)
```

converts to:

```
Y = USR (X/2)
```

The USR function is used here because its syntax is similar to Peek.

The Confuse-an-Apple program makes use of three of the more unusual features of the Apple: the COut hook, the ampersand and the USR function. Characters are normally printed to screen through the COut routine in Apple's monitor, but they can be rerouted via the COut hook at locations $36 and $37 to a user subroutine anywhere in memory.

The cursor-control module makes use of this to intercept each character before it goes to screen. If a ^ is found then it is assumed that all characters from then on are cursor-control commands. A second ^ causes a switch back to normal printing mode.

Wherever a & occurs in an Applesoft program it will cause a jump to a subroutine at $385, used by the &Poke module. The subroutine first checks that the keyword Poke follows the & sign. Anything else will result in a syntax error. Next it evaluates both expressions and checks that they are within range. If not, an illegal-quantity error is displayed. The address in the first expression is converted to its Apple counterpart and the value of the second expression is stored at that address.

The USR function is designed to pass floating-point numbers from Basic to machine-code routines. The Peek module immediately converts the number to an integer and checks that it is within range. If not, an error message occurs. The Pet address is again converted to an Apple address and the routine returns to Basic with the contents of that memory location in the floating-point accumulator.

Confuse-an-Apple sits in memory just below DOS and should be protected from being overwritten by moving Himem below it. It should be initialised at the beginning of your program with a Call 37632 statement, and it would be wise to disconnect it before you exit with a Call 37684. The example listing demonstrates all three features of Confuse-an-Apple.

Demonstration program.

```
  8 REM CONFUSE-AN-APPLE
  9 REM   DEMONSTRATION
 10 HIMEM : 37632
 20 CALL 37632
 30 LIST : LIST : LIST
 40 FOR X = 32768 TO 33727
 50 IF USR ( X ) = 160 THEN &POKE X,174
 60 NEXT X
 70 POS$ = "^RRRRRRRRRRRRRRRRRRRDDDDDDDDDD^"
 80 PRINT POS$ ; "^^RRF^B^LDDI^C^LLLLNB^D"
 90 CALL 37684
100 END
```

Confuse-an-Apple listing.

```
SETBUG    9300-  A9 4C       LDA   #$4C
          9302-  85 0A       STA    $0A      USRADD1
          9304-  8D F5 03    STA    $03F5    AMPADD1
          9307-  A9 30       LDA   #$30
          9309-  85 0B       STA    $0B      USRADD2
          930B-  A9 94       LDA   #$94
          930D-  85 0C       STA    $0C      USRADD3
          930F-  A9 18       LDA   #$18
          9311-  8D F6 03    STA    $03F6    AMPADD2
          9314-  A9 94       LDA   #$94
          9316-  8D F7 03    STA    $03F7    AMPADD3
SETBUG2   9319-  A9 00       LDA   #$00
          931B-  85 FD       STA    $FD      BUGFLG
          931D   A9 93       LDA   #$93
          931F-  C5 37       CMP    $37      CSWH
          9321-  F0 10       BEQ    $9333
          9323-  A5 36       LDA    $36      CSWL
          9325-  85 FA       STA    $FA      TEML
          9327-  A5 37       LDA    $37      CSWH
          9329-  85 FB       STA    $FB      TEMH
          932B-  A9 55       LDA   #$55
          932D-  85 36       STA    $36      CSWL
          932F-  A9 93       LDA   #$93
          9331-  85 37       STA    $37      CSWH
RT1       9333-  60          RTS

CLRBUG    9334-  A5 FB       LDA    $FB      TEMH
          9336-  85 37       STA    $37      CSWH
          9338-  A5 FA       LDA    $FA      TEML
          933A-  85 36       STA    $36      CSWL
RT2       933C-  60          RTS

CHAR      933D-  D5 C4 D2 CC C9 C6
                 CE C8 C3 C5 D3 C2

ADD       9349-  89 8C 92 95 98 9D
                 A1 A5 B0 B6 BC C2

BUG       9355-  C9 DE       CMP   #$DE
          9357-  D0 0C       BNE    $9365
FLGSET    9359-  A5 FD       LDA    $FD      BUGFLG
          935B-  D0 04       BNE    $9361
ON        935D-  E6 FD       INC    $FD      BUGFLG
          935F-  D0 DB       BNE    $933C
OFF       9361-  C6 FD       DEC    $FD      BUGFLG
          9363-  F0 D7       BEQ    $933C
CHKFLG    9365-  48          PHA
          9366-  A5 FD       LDA    $FD      BUGFLG
          9368-  D0 04       BNE    $936E
          936A-  68          PLA
          936B-  6C FA 00    JMP   ($00FA)   (TEML)
MOD       936E-  68          PLA
          936F-  86 FC       STX    $FC      SAVE
          9371-  A2 0B       LDX   #$0B
LOOP      9373-  DD 3D 93    CMP    $933D,X
          9376-  F0 06       BEQ    $937E
          9378-  CA          DEX
          9379-  10 F8       BPL    $9373
          937B-  A6 F6       LDX    $FC      SAVE
          937D-  60          RTS

FOUND     937E-  A9 93       LDA   #$93
          9380-  48          PHA
          9381-  BD 49 93    LDA    $9349,X
          9384-  48          PHA
          9385-  A6 FC       LDX    $FC      SAVE
          9387-  84 FC       STY    $FC      SAVE
          9389-  60          RTS

U         938A-  4C 1A FC    JMP    $FC1A    UP

D         938D-  20 66 FC    JSR    $FC66    DOWN
          9390-  A4 FC       LDY    $FC      SAVE
          9392-  60          RTS

R         9393-  4C F4 FB    JMP    $FBF4    RIGHT

L         9396-  4C 10 FC    JMP    $FC10    LEFT

I         9399-  A9 3F       LDA   #$3F

X         939B-  85 32       STA    $32      INVFLG
          939D-  60          RTS

F         939E-  A9 7F       LDA   #$7F
          93A0-  D0 F9       BNE    $939B

N         93A2-  A9 FF       LDA   #$FF
          93A4-  D0 F5       BNE    $939B

H         93A6-  A5 22       LDA    $22      WINTOP
          93A8-  85 25       STA    $25      CV
          93AA-  A9 00       LDA   #$00
          93AC-  85 24       STA    $24      CH
          93AE-  4C 24 FC    JMP    $FC24    HOME

C         93B1-  20 58 FC    JSR    $FC58    CLEAR
          93B4-  A4 FC       LDY    $FC      SAVE
          93B6-  60          RTS

E         93B7-  20 9C FC    JSR    $FC9C    CLEOL
          93BA-  A4 FC       LDY    $FC      SAVE
          93BC-  60          RTS

S         93BD-  20 42 FC    JSR    $FC42    CLEOP
          93C0-  A4 FC       LDY    $FC      SAVE
          93C2-  60          RTS

B         93C3-  20 DD FB    JSR    $FBDD    BELL
          93C6-  A4 FC       LDY    $FC      SAVE
          93C8-  60          RTS

IQE       93C9-  4C 99 E1    JMP    $E199    ILLERR

SE        93CC-  4C C9 DE    JMP    $DEC9    SYNERR

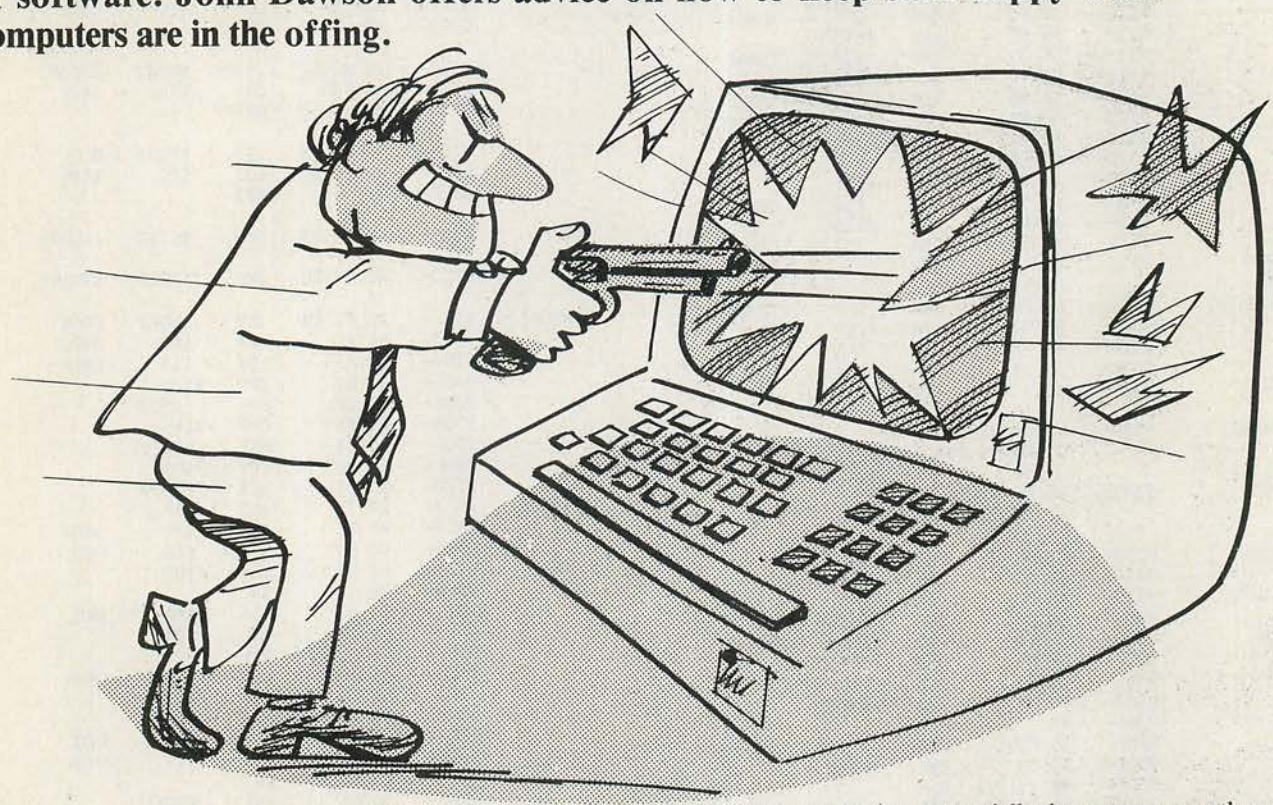
CONVERT   93CF-  20 F2 EB    JSR    $EBF2    FPIN
          93D2-  A5 A0       LDA    $A0      INTL
          93D4-  A4 A1       LDY    $A1      INTH
          93D6-  C9 80       CMP   #$80
          93D8-  30 EF       BMI    $93C9
          93DA-  C9 83       CMP   #$83
          93DC-  90 04       BCC    $93E2
          93DE-  C0 C0       CPY   #$C0
          93E0-  B0 E7       BCS    $93C9
CONVERT2  93E2-  29 7F       AND   #$7F
          93E4-  85 A1       STA    $A1      INTH
          93E6-  84 A0       STY    $A0      INTL
DIV40     93E8-  A2 00       LDX   #$00
LOOP1     93EA-  38          SEC
          93EB-  A5 A0       LDA    $A0      INTL
          93ED-  E9 28       SBC   #$28
          93EF-  A8          TAY
          93F0-  A5 A1       LDA    $A1      INTH
          93F2-  E9 00       SBC   #$00
          93F4-  30 07       BMI    $93FD
          93F6-  84 A0       STY    $A0      INTL
          93F8-  85 A1       STA    $A1      INTH
          93FA-  E8          INX
          93FB-  D0 ED       BNE    $93EA
OUT       93FD-  A4 A0       LDY    $A0      INTL
          93FF-  8A          TXA
CONV      9400-  48          PHA
          9401-  4A          LSR
          9402-  29 03       AND   #$03
          9404-  09 04       ORA   #$04
          9406-  85 FF       STA    $FF      INTH2
          9408-  68          PLA
          9409-  29 18       AND   #$18
          940B-  90 02       BCC    $940F
          940D-  69 7F       ADC   #$7F
CONV2     940F-  85 FE       STA    $FE      INTL2
          9411-  0A          ASL
          9412-  0A          ASL
          9413-  05 FE       ORA    $FE      INTL2
          9415-  85 FE       STA    $FE      INTL2
          9417-  60          RTS

AMPER     9418-  C9 B9       CMP   #$B9
          941A-  D0 B0       BNE    $93CC
          941C-  20 B1 00    JSR    $00B1    CHRGET
          941F-  20 67 DD    JSR    $DD67    GETEXPR
          9422-  20 CF 93    JSR    $93CF
          9425-  98          TYA
          9426-  48          PHA
          9427-  20 4C E7    JSR    $E74C    XGET
          942A-  68          PLA
          942B-  A8          TAY
          942C-  8A          TXA
          942D-  91 FE       STA   ($FE),Y   (INTL2)
          942F-  60          RTS

USR       9430-  20 CF 93    JSR    $93CF
          9433-  B1 FE       LDA   ($FE),Y   (INTL2)
          9435-  A8          TAY
          9436-  A9 00       LDA   #$00
          9438-  4C F2 E2    JMP    $E2F2    INFP
```

Computers in

For managers introducing new technology the problems do not end with the choice of software. John Dawson offers advice on how to keep staff happy when computers are in the offing.



INDUSTRIAL RELATIONS can be a positive part of management as well as the bloody-minded antagonism usually reported to the public. It makes no difference whether you are introducing a computer with 100 terminals scattered across the west of England for stock control or bringing in a single-operator Apple for repeat prescribing in a GP's surgery. The history of computing, small and large, is littered with the debris of poor industrial relations and in this area, at least, the problem is international rather than being confined to Britain.

Large-scale computing systems have revolutionised the management of many companies involved in providing goods or services or in handling information. Computing systems interact with historical and organisational goals and political pressures to shape the internal structure of the company. Yet that is not the whole of the problem: computing systems of all sizes shape the way in which organisations interact with individuals.

The industrial relations of introducing a computer into an organisation may require formal negotiations with unions or simply talking to people and helping them through a minor crisis at work. For both real and mythical reasons computers are threatening to someone who is simply told to use one or, worse still, excluded from a new project to use computers at work.

When you set about introducing a computer you are acting, in effect, as both systems analyst and designer. Systems analysis is threatening to many grades of staff: if you lean on the desk of a subordinate for half an hour asking questions and then leave with the attitude that it is all pretty simple you deny that person the expertise that they have taken years to acquire. You should aim to synthesise a design for a system that will build on the experience of staff and, in doing so, offer work to those staff that is more satisfying.

If there has never been a computer in your department and you can see applications for a machine then you have the opportunity to plan and work through the introduction of a system free from many of the hampering attitudes that can lead to rejection of computers out of hand. There are many positive benefits for any grade of staff involved in using a computer, and with careful management it is possible to achieve most of the benefits without the disadvantages that may also occur.

The two ends of the spectrum of applying computers to tasks within an organisation are essentially the same as any other aspect of management. At one end is the authoritarian didactic style and at the other a *laissez faire* leaderless group approach.

It is possible to instruct subordinate staff to use a new computer system and then obtain very detailed information from the machine about the number of keystrokes in each hour made by a data-preparation operator, or the rate at which a typist using a word processor generates standard letters. The performance of a middle-grade sales executive, for example, can be monitored in far greater detail than before by the automatic calculation of indices based on his or her sales figures.

After a computer was installed at the head office of one chain store local managers came to dread Monday morning because the machine was programmed to deliver reports of each store's performance to a senior manager before they arrived on the store manager's desk. Arbitrary and punitive systems are all too easily established, and the damage they can cause to a company's operations is out of all proportion to any small support given to the position of an insecure senior executive.

Conversely, it is possible to introduce a computer or word processor as a tool that may be used by staff when they think they

workers out?

have a job that can be done better on the machine than by a manual method. The choice of using the machine or not using the machine then rests with the individual, who will continue to report to his or her manager about progress towards various objectives, as they did before the computer arrived.

Which route will you follow? Within limits, neither is necessarily better or worse than the other, and success will depend on the style of management already in existence in your organisation. But the wrong approach can generate intense passive resistance or even active violence towards the computer: one man took a large-calibre revolver and shot an American computer to relieve his frustration and anger.

Table 1 illustrates how common sense and courtesy can be combined to forge a successful management approach to information systems which directly affect the staff of an organisation. A similar approach by anyone planning to introduce a computer will lay a solid foundation for success. If you are involved in the introduction of a computer for work that does not involve keeping information about your employees on the machine you will still need co-operation, enthusiasm and initiative if the application is to be successful.

The cardinal rule for bringing in a machine is to involve both the people who will use the machine and those who will be affected by it from the earliest possible stage, and listen to what they have to say. Listen not only to the words but to how they are said. Bringing in a computer is a crisis to many people, and you may hear arguments on one level accompanied by contradictory voice inflections or non-verbal signals.

Reasons for wanting a computer in an office or refusing to consider the possibility of a machine may be irrational, camouflaging personality clashes or collective discontent. Are there nuances that will reveal a latent discontent, leading in time to a pay claim for operating the computer or disproportionate trouble over the noise made by a cooling fan or printer? Remember that participation in making decisions about the computer system will help to commit people to the success of the venture. You are unlikely to infect everyone with your own degree of enthusiasm, so aim for satisfactory solutions to problems rather than total conversion.

In practical terms, you will need a steering group to agree how the system is to be introduced: another committee in a world already sinking beneath the weight of discarded plastic coffee cups left over from diffuse, frustrating discussions that go nowhere and achieve less. Yet whether you have a formal committee or a gang of people who meet from time to time to overcome common problems, you must talk through the introduction of any effective computer system before it arrives and for some time afterwards.

Time spent in the steering group is an investment that will pay you handsome dividends over and over again as your plans progress. The steering group will have to include both the people who will use the computer and those who will simply be affected by the machine. Nothing will lead you more quickly towards an industrial-relations disaster than spending time with the people who are playing with the new toy to the exclusion of staff doing a long-standing and valuable job for the company. An overall agenda for consideration by the steering group is set out in the panel on the next page.

As well as working with the steering group you should talk individually to members of staff in your department. Each of them will have a personal perspective on the machine; some will feel threatened about losing their job, others may fear a loss of status or that their work will become merely a matter of sitting in front of a terminal with a loss of social contact with other members of the department. Before the first meeting of the steering group you should have talked individually to all the people who report to you and should have eliminated as far as possible hositle or aggressive attitudes.

You cannot evade the question of job losses or job displacement. If you plan to reduce the number of staff as a consequence of introducing the computer system then you will do so most successfully by honestly declaring your intentions at an early stage. Staff should be given the opportunity to prepare alternative proposals, which will often have real benefit for the organisation. If you do hide the intention of making staff redundant then the remaining staff are unlikely to trust you in the future.

There are differences between small computers and large systems when you come to press the switch that will start the machine for its first day of work. A small computer will often be employed for a number of tasks, and the order in which you start to put them on to the machine may be far more flexible than on a larger

(continued on next page)

Table 1. Criteria for humanising management information systems.

Procedures for dealing with users

The language of a system should be easy to understand

Transactions with a system should be courteous

A system should be quick to react

A system should respond quickly to users if it is unable to resolve its intended procedure

A system should relieve users of unnecessary chores

A system should provide for human information interface

A system should include provisions for corrections

Management should be held responsible for mismanagement

Procedures for dealing with exceptions

A system should recognise as much as possible that it deals with different classes of individuals

A system should recognise that special conditions might occur that could require special actions by it

A system must allow for alternatives in input and processing

A system should give individuals choices on how to deal with it

A procedure must exist to override the system

Action of the system with respect to information

There should be provisions to permit individuals to inspect information about themselves

There should be provisions to correct errors

There should be provisions for evaluating information stored in the system

There should be provisions for individuals to add information that they consider important

It should be made known in general what information is stored in systems and what use will be made of that information

The problem of privacy

In the design of a system all procedures should be evaluated with respect to both privacy and humanisation requirements

The decision to merge information from different files and systems should never occur automatically. Whenever information from one file is made available to another file it should be examined first for its implications for privacy and humanisation

Guidelines for system design having a bearing on ethics

A system should not trick or decieve

A system should assist participants and users and not manipulate them

A system should not eliminate opportunities for employment without a careful examination of consequences to other available jobs

System designers should not participate in the creation or maintenance of secret data banks

From Computers and Management in a Changing Society *by Donald Sanders and Stanley Birkin*

Steering groups

A steering group can provide a means of focusing discussion on to issues surrounding the introduction of a computer. The group will be useful after the machine has arrived as well as during the planning stages. Dealing with the choices and problems that surround the introduction of a computer can be a rewarding part of working with other people; equally, bad management, suspicion and unresolved hostility can wreck a well-intended and useful plan.

- The time-scale for implementation. Will the whole system start work from day 1 or will parts of the system be brought into operation at different times? Will you choose the "big bang" approach to entering data into the computer, aiming to transfer your records within the shortest possible time? Or will you go the "continuous evolution" route in which you put all your new records and transactions on to the machine and work backwards through your old records at a defined and agreed rate to add them to more recent ones?
- Personnel. Do you plan to train a group of people to use the computer, excluding others from operating the machine; or will all the staff in the department be able to do work on the machine? I have seen incipient problems in a GP surgery where the computer terminal was placed in an upstairs room and a single person was responsible for developing the system to the stage where other members of the staff could use the computer on a routine basis. The woman entering the data began to feel isolated from the other members of the staff, and discontent about "that computer upstairs" could be felt among the clerks working on the reception desk. At the same time there may be sound reasons for making one person responsible for "housekeeping" tasks around the computer.
- Associated changes in the organisation. The Health and Safety at Work Act should concern you at this point. Some of the wilder claims about the dangers of VDUs have subsided but there are occupational-health matters as well as the pragmatic details of office organisation.

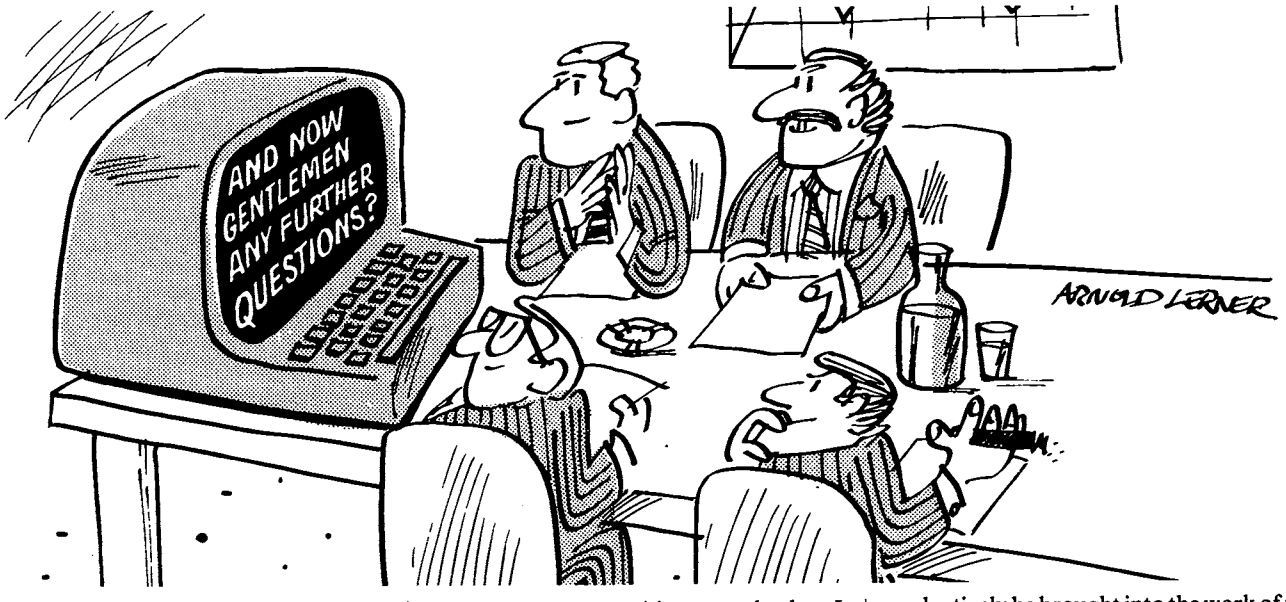
Using a VDU can precipitate a binocular instability in people who manage very well in normal circumstances. Concentrating for long periods on a screen at a close distance and typing from unsupported documents can generate headaches and backache if the ergonomics of the VDU and keyboard design are inadequate. Just because the equipment looks smart it's not always comfortable to use.

Will you need to resite telephones or desks to allow the computer to function efficiently? Printers are noisy and distracting pieces of equipment, and though acoustic hoods are available they take up considerable areas of desk space. How will the inevitable wires be routed to avoid the risk of somebody tripping and breaking their neck?

Will the lighting in the office have to be altered to avoid glare from the VDU screen? What changes in work flow will there be within your department and between you and other parts of the organisation? For example, a general practitioner will have to print out the notes held on his or her computer when a patient moves and registers with another doctor. The task is routine but should be planned for a quiet part of the week.

- Plan for failure. Things will go wrong at any level, from incorrectly installed keytops on the keyboard so that the instruction manual does not match the terminal you are using, all the way up to the loss of 10Mbyte of typing when someone erases a hard disc with no back-up copy. RS-232 serial terminals are standard only in that the same label is used for the interface.

What will you do when your keen, highly motivated office junior or surgery receptionist says "I'm not going back on that bloody machine"? How will you cope when somebody disconsolately brings you a printout that looks like a hex dump of the machine's monitor program and says "I can't get that letter on the word processor to print properly"? You will be lucky to avoid a trough in morale some time during the machine's installation period. If you are not prepared it can shake your own confidence, and that will be a disaster.



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installation. In other words, your choice of the first job to go on to the computer may be made for reasons that have nothing to do with the mechanics of the system; it can be made for human reasons.

Choose an application that offers immediate results. There is nothing like a quick victory to hearten the troops and consolidate your position as a leader. In small operations such as a general practice or hospital department, for example, word processing is an encapsulated use for the computer which you should be able to implement quickly without having to enter vast quantities of data. Users will be able to see results from a word-processing program in as little as 20 minutes and it can productively be brought into the work of the surgery or the department in a few days.

Resist the temptation to move on to the next application too quickly. Assess the attitudes of the users before your personal thirst for progress has you rushing ahead. As with all management you must aim to lead from the front, but without being so far in advance as to be out of touch.

When it's time to stop playing games and get down to business...

Unfortunately, many of today's desk top computers are designed with too much emphasis on home use. That's fine, if you want to balance your checkbook, play "space war" or draw pictures. But when you have serious business requirements for a computer, you want one designed specifically for business.

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SYSTEM SPECIFICATION
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RAM Memory: 256 kbytes expandable to 1024 kbytes
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Storage Options: Up to 4 add-on Winchester drives plus streaming tape backup
Communications: 4 workstation ports (RS-422-compatible), plus 2 synchronous/asynchronous programmable RS-232 ports

WORKSTATIONS (up to 4)
Keyboard: Ergonomic, low-profile, 83 keys, 10 programmable function keys, 10-key numeric keypad (with cursor/editing functions)
Color Display: High-resolution, 80 characters x 25 lines, upper and lower case, 8 programmable foreground/background colors
Printer: Bidirectional, 80 characters-per-second, friction and tractor feed

SOFTWARE
Operating System: User-friendly, multi-tasking, CP/M, MP/M, PC-DOS compatible
Languages: BASIC, COBOL, Pascal
Applications: Spreadsheet, Database, Text Processing Communications

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the RAIR Business Computer.

Looking ahead on a micro

Adrian Hill describes how to forecast the effect of altering one variable in complex real-life systems.

ONE WIDELY USED method of forecasting is to devise a model which accurately reflects the past behaviour of a system and then uses it to predict the future behaviour. The model is usually a mathematical one: in general, the more complex the model the more accurate the results, and it is common to use extensive sophisticated numerical methods in good models.

The KSIM forecasting method uses very simple mathematics. There is one equation to use, and the most complex function used is exponentiation, but though the maths is fairly simple the results can be useful.

The method was devised by Julius Kane and is now one of the standard methods used in systems dynamics, a discipline concerned with the way in which a system's parts interact to influence its overall behaviour. KSIM is specifically concerned with finding the particular variables relevant to the behaviour of the system and evaluating the way in which pairs of variables affect each other.

For example, if you wish to examine the behaviour of a simple local transport system you might decide to consider:

- use of private cars
- use of buses
- use of tube
- price of petrol
- price of diesel
- price of electricity

These variables are not the only ones which could be considered; they are simply possible candidates.

```
rem
rem  ***********************************************
rem
rem       KSIM simulation program
rem       written for BASIC-E compiler
rem       running under CP/M.
rem
rem  ***********************************************
rem
rem  ***********************************************
rem
rem       variables etc. used in this program
rem
rem       cim(x,y) - cross impact matrix
rem       vname$(x) - variable name
rem       vval(x) - current variable magnitude
rem       nval(x) - next variable magnitude
rem       z1 ... z17 - counters
rem       an$ - users response
rem       var - number of variables
rem       inerr$ - input error flag
rem       temp - processed user response
rem       ins - no. of steps in time period
rem       per - time period
rem       namef$ - file name
rem       tempu  )
rem       tempi  )  parts of the main
rem       tempv  )  equation.
rem       temps  )
rem       xpou   )
rem       xpol   )  parts of exponent
rem       sxpo   )
rem       za$ - unused user response
rem  ***********************************************
rem
rem    set up arrays with max. no. of elements
rem
 dim  cim(20,20), vname$(20), vval(20), nval(20)
rem
rem  *** print into. message to screen          ***
rem
 for z2 = 1 to 5
  print chr$(12)
   for z1 = 1 to 250 : next
  print : print
  print"     * * * * * * * * * * * * * * * * * * * *"
  print"     *                                     *"
  print"     *   K S I M   S I M U L A T I O N     *"
  print"     *   =======   ===================     *"
  print"     *                                     *"
  print"     *                                     *"
  print"     *    adapted by A P Hill, Jan '82     *"
  print"     *   from a method by Julius Kane.     *"
  print"     *                                     *"
  print"     * * * * * * * * * * * * * * * * * * * *"
   for z1 = 1 to 750 : next
 next z2
rem
rem  ***  check if data is on disk, or to be    ***
rem  ***  input manually from the console.      ***
rem
 print chr$(12)
 input"    is your data already on disk (y/n)";an$
 if (an$ = "Y") or (an$ = "y") then 20 else 30
rem
rem  ***  load data from disk file in next section  ***
rem
20 input"    enter the name of the data file"; namef$
 file namef$
 print"    reading data...."
 read #1; var
 for z3 = 1 to var
  read #1; vname$(z3)
 next z3
 for z9 = 1 to var
  for z8 = 1 to var + 1
   read #1; cim(z9,z8)
  next z8
 next z9
 for z7 = 1 to var
```

	Car use	Bus use	Tube use	Petrol price	Diesel price	Elec. price	Ext. sources	Starting value
Car use	−1	0	+1	−2	+2	+1	+1	0.7
Bus use	−1	+1	−1	+1	−1	+1	−1	0.3
Tube use	+1	−1	−1	+1	+2	−1	0	0.5
Petrol price	−1	+1	0	−1	+2	+1	+1	0.6
Diesel price	+1	0	−1	+2	0	+1	+1	0.6
Electricity price	0	0	0	+1	0	0	+1	0.6

The impact is that of the variable along the top, on the variable down the side.
Table 1. Cross-impact table for local transport example.

Any number of variables could be chosen: with six variables there are 36 interactions, or cross-impacts, between pairs. An extra variable must be added to represent the impact of all other sources on each of your six variables. There is no need to consider the impact of your variables on this external variable as it is assumed that they have no significant effect.

A numerical notation is used to denote the effect of the cross-impacts. In this implementation the values are limited to the range 0 to 3, though in other programs the range may easily be changed. The number indicates the magnitude of the impact: a cross-impact value of zero indicates that the variables have no effect on each other; a value of 3 indicates a very large effect. The cross-impacts may be either positive or negative. A positive impact indicates that the effect is in the same direction, and a negative impact indicates that the effect is in the opposite direction to the cause.

Once you have decided the values of the cross-impact variables they can be tabulated as shown in table 1. Three of the values were arrived at as follows:

Impact of petrol price on car use: if petrol costs rise, people are more reluctant to use their cars; impact is −2.

Impact of petrol price on tube use: if people use cars less as petrol price increases, some of them will use tube; impact is +1.

Impact of diesel price on petrol price: when diesel price rises, all other oil products would probably increase in price; petrol is transported in trucks; impact is +2.

In the cross-impact table the most important column is the one marked External. In it you can change the number to represent the effect of any extra conditions you may wish to impose on the system. This can be useful for evaluating the effect of proposed new legislation: for example, if you wish to see what the effect would be of prohibiting the use of private cars use the value −3 for the impact of External upon car use.

After testing the other values in the cross-impact table with a few trial runs you adjust them to give a fairly good representation of the past behaviour of the system. The model is then ready to predict future behaviour, and you can alter the External effects to test particular options open to the system.

Having set up the cross-impacts it is necessary to represent the actual magnitude of the variables. The KSIM method requires that the values representing the magnitude of the variable must lie in the range 0 to 1. If you consider that car use is now as high as it could be, allocate the value 1; if you consider tube use is very low, use the value 0.1. The

(continued on next page)

```
    read £1; vval(z7)
   next z7
   read £1; per, ins
   close 1
   print"    all data loaded."
   goto 180
  rem
  rem  ***  load data from console in next section.     ***
  rem
30  print : print
   input"    how many variables"; var
   print"    now enter a name for each variable:"
    for z10 = 1 to 500 : next
   print chr$(12)
   for z6 = 1 to var
    print"   no."; z6 ;" variable name";
    input vname$(z6)
   next z6
   print chr$(12)
   print : print
   print"   now enter the cross impact values:"
   print"   use values between 0 and 3."
   print"   either +ve or -ve."
   print : print
   for z5 = 1 to var
    for z4 = 1 to var
100   print"   impact of "; vname$(z4);" on "; vname$(z5);
     gosub 1000
     if (inerr$ = "yes") then print"** invalid entry **": goto 100
     cim(z5,z4) = temp
    next z4
110  print"    impact of EXTERNAL on ";vname$(z5)
    gosub 1000
    if(inerr$ = "yes") then print"** invalid entry **": goto 110
    cim(z5,var + 1) = temp
   next z5
   print chr$(12)
   print : print
   print"   now allocate starting value "
   print"   for each variable."
   print : print"   use values between 0.00 and 1.00"
    for z11 = 1 to var
120   print"   enter value for "; vname$(z11);
     input temp
     if ( temp>1.00) or ( temp<0) then 130 else 140
130   print"** invalid entry **" : goto 120
140   vval(z11) = temp
    next z11
    print chr$(12)
    print : print : print
    input"   state time period in years"; per
    print : print
    input"   state number of steps within this period"; ins
   rem
   rem  ***  check if data is to be written to          ***
   rem  ***  the data file for future use.              ***
   rem
180  print chr$(12)
    print : print : print
    input"   write data to 'KSIMDATA' (y/n)"; an$
    if ( an$<>"Y") and ( an$<>"y") then 190
   rem
   rem  ***  write data to disk file in next section.   ***
   rem
    namef$ = "KSIMDATA"
    file namef$
    print £1; var
    for z12 = 1 to var
     print £1; vname$(z12)
    next z12
    for z13 = 1 to var
     for z14 = 1 to var + 1
      print £1; cim(z13,z14)
     next z14
    next z13
    for z15 = 1 to var
     print £1; vval(z15)
    next z15
    print £1; per, ins
    close 1
    print : print
```

(listing continued on next page)

Looking ahead on a micro

(continued from previous page)

allocated values should reflect the magnitude of the variable at the start of the simulation.

If you want the model to reflect the past behaviour of the system, allocate values that reflect the state of each variable at that time in the past from where your run is to start. The values are only set at the start of the simulation; the program itself will change them as the simulation proceeds so that they always represent the current value of each variable. With the variables identified, set up and evaluated, you now have to specify the period for which you wish the simulation to run and the length of the time intervals within that period.

The KSIM method calculates the new value for the magnitude of each variable once during each time interval according to the following rules:

- A variable will increase or decrease in magnitude according to whether the net impact upon it from the other variables is positive or negative.
- A variable is less susceptible to the impact of other variables as it approaches its own upper and lower limits.
- A variable produces a larger impact on the whole system as its magnitude increases.

The new value for the magnitude of a variable at the new time $(t + \Delta t)$ is related to the old value at time t by the following transformation:

$$[x_i(t + \Delta t) \leftarrow x_i(t)^{P_i}$$

where the exponent P_i is given by:

$$P_i(t) = \frac{1 + \frac{\Delta t}{2} \sum_{j=1}^{N} (|\alpha_{ij}| - \alpha_{ij})\ x_j}{1 + \frac{\Delta t}{2} \sum_{j=1}^{N} (|\alpha_{ij}| + \alpha_{ij})\ x_j}$$

where Δt is the time interval and α_{ij} is the cross-impact of variable x_j on variable x_i.

Although the equation looks involved, when expressed in ordinary English rather than mathematical notation it becomes:

(1 + ((½ of time interval) × (sum of − ve impacts))) ÷ (1 + ((½ of time interval) × (sum of + ve impacts)))

The value of P_i varies for each of the variables according to the value of the cross-impacts upon it and the magnitude of the variable acting on it. It must be calculated explicitly each time it is required.

The program is written for the Basic-E compiler running under CP/M. Non-CP/M users may be unfamiliar with the fact that line numbers are optional on statements other than those to which control is passed directly. Figure 1 shows the algorithm on which it is based. The main part consists of three nested For-Next loops. The inner loop evaluates the sum of the cross-impacts from each variable to give the exponent required by the middle loop, which recalculates the magnitude of each variable. Each calculation is done once during each loop of the outer loop, which represents the time period.

The program is self explanatory when running, but you should note down the cross-impact table and starting values before starting as it is easy to become confused when entering lots of numerical data. The first input required is to state whether you will enter data manually from

(listing continued from previous page)

```
    print"   written data to 'KSIMDATA'."
   rem
   rem  ***  next section is the part including          ***
   rem  ***  all of the calculations.                    ***
   rem
190  print chr$(12)
     print : print
     print"    Ready to proceed...."
     print : print
     input"   enter any key to start."; za$
     print chrS(12)
     namef$ = "KSIMRSLT"
     file namef$
     pbi = per / ins
     print £1; var
   rem
     for time = 1 to per step pbi
   rem  ***  Add plotting routine here.                  ***
   rem  ***  to plot nval(1) ..... nval(var)             ***
   rem  ***  if graphics are available in your system.   ***
      for z13 = 1 to var
       tempu = 0 : templ = 0
   rem
   rem
       for z14 = 1 to var + 1
        tempv = cim(z13,z14)
        temps = (vval(z13))*tempu
        if ( tempv<0 ) then 300
        templ = templ + temps
        goto 400
300     tempu = tempu + abs(temps)
400    next z14
       xpou = 1 + ( pbi * tempu )
       xpol = 1 + ( pbi * templ )
       sxpo = xpou / xpol
       nval(z13) = vval(z13)↑sxpo
      next z13
      for z17 = 1 to var
       vval(z17) = nval(z17)
       print £1; nval(z17)
      next z17
      print"    completed time period no."; time
       print : print
     next time
   rem
   rem  ***   this is the end of the main section       ***
   rem  ***   now print final value of each variable    ***
   rem  ***   to the screen.                            ***
   rem
     print chr$(12)
     print : print
     print"    Final Values are:"
     print
     for zz = 1 to var
      print"  ";vname$(zz);"  - "; int(100*nval(zz))/100
     next zz
     stop
   rem
   rem  ***  next section is the subroutine to test     ***
   rem  ***  that the cross-impact values lie in the
   rem  ***  range 0 to 3.                              ***
   rem
1000  input temp
      if ( abs(temp)>3) then 1100
      inerr$ = "no"
      return
1100  temp = 0
      inerr$ = "yes"
      return
   rem
   rem  ***      end of this program.                   ***
   rem
    end
```

the keyboard or load it from a disc file. If manual entry is selected, the inputs required are:

- The names to be used for each variable.
- The cross-impact table, one element at a time, entered by name as prompted by the program.
- Starting magnitudes for each variable.
- The time period to be used for the run.

The results output to the results file are intended for plotting in graphical form and are not labelled in any way. The plotting should ideally take place during the simulation run, in which case numerical output to the results file would not be required.

No graph-plotting routine is included in the program, as graphics capabilities vary too widely from machine to machine for such an example routine to be of any use; individual users should add such routines as their machines will allow where indicated in the program. If this is not possible, then either the results should be plotted by a separate program or drawn by hand.

The program opens the results file as a sequential file and will write in the results as a simple list of numbers. The first number is not actually part of the results but simply states the number of variables used in the simulation. The results themselves follow, and are the successive magnitudes for each variable.

For each time interval there will be one new value for each of the variables. You must skip several results each time. For example, if there were five variables in the simulation then reading every fifth number in the results file would give the successive magnitudes of one of the variables.

The program creates an additional output file containing the cross-impact and initial magnitude data, together with the time period and number of intervals in a form suitable for direct reading by the program as input data at any subsequent run. This file is named KSIMData, the results file being KSIMRslt.

The KSIM method is capable of producing very realistic results but, as always, poor data gives poor results. To generate an accurate simulation of a real system you must be quite sure you have included all relevant variables and used suitable values for the cross-impacts and original magnitudes. The choice of which variables to include in the system, their original magnitudes and the cross-impacts are all subjective decisions. Real systems may be influenced by many more sources than are apparent, and if any of these sources are omitted from a simulation the results will be invalid.

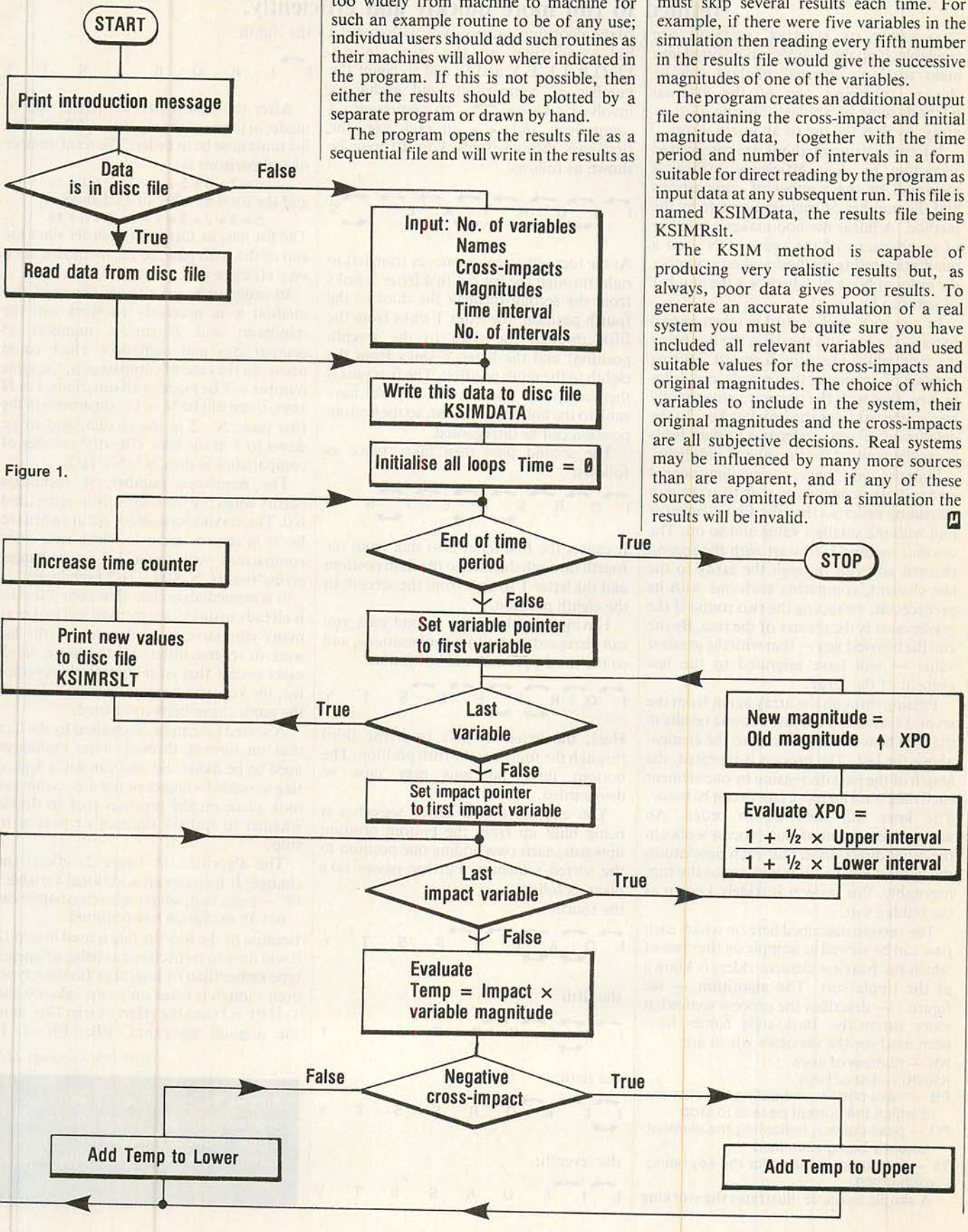


Figure 1.

Know your sort

Starting with a simple sorting procedure, Andrew Featherstone explains how it can be refined to run more quickly and efficiently.

TWO KINDS OF SORTING METHOD are available: if all the records can be fitted into main store an internal method can be chosen, otherwise one of the external methods must be applied. Sorting a list or array involves the use of an internal sort.

Internal sorting methods are categorised according to their efficiency, which is measured by the number of comparisons and the number of exchanges made by the method. A linear method makes a number of comparisons of the order of N^2 and a quadratic sorting method makes a number the order of $N\log_2 N$, where N is the number of items to be sorted.

In any sort, each record is taken in two parts — the key and the data, the key being the field which identifies a record. Sorting consists of arranging the records into order by key, that with the greatest value usually being referred to as the heaviest key. In the description of sorts, reference to data fields is usually omitted for the sake of simplicity.

Suppose you have a one-dimensional array whose elements you wish to arrange in ascending order so that the first element is that with the smallest value and so on. The obvious method is to start with the second element and run through the array to the last element, comparing each one with its predecessor, swapping the two round if the predecessor is the greater of the two. By the end the heaviest key — that with the greatest value — will have migrated to the last element of the array.

Passing through the array again from the second element to the last but one results in the next heaviest key sinking to the element above the last. The process is repeated, the length of the pass decreasing by one element each time until no more passes can be made. The keys will then be in order. An alternative version of this process works in the other direction so that each pass causes the lightest key to "bubble" up to the top; inevitably, this version is widely known as the bubble sort.

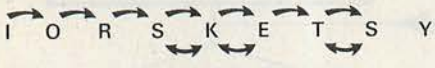
The version described here, in which each pass can be viewed as a ripple on the crest of which the heaviest element rides, is known as the ripple sort. The algorithm — see figure 1 — describes the process somewhat more succinctly. Basic-style names have been used for the variables which are:

NK — number of keys
K$(NK) — list of keys
PB — pass bottom, indicating the element at which the current pass is to stop
PP — pass pointer, indicating the element currently being examined
T$ — temporary location for the key being exchanged.

A simple example illustrates the working of the algorithm. Suppose you wish to sort a list consisting of the nine letters I,S,O,R,T,K,E,Y and S, and to count the number of comparisons and exchanges involved. Using ⌒ to represent a comparison and ⌣ an exchange, the first pass through steps 3 to 10 may be shown as follows:

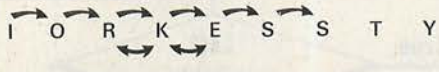
As the focus of attention moves from left to right through the list the first letter S sinks from the second through the third to the fourth position, the letter T sinks from the fifth through the sixth to the seventh position, and the letter Y sinks from the eighth to the ninth position. The first pass is then complete. The heaviest key will have sunk to the bottom of the list, so the bottom position can be disregarded.

The second pass then takes place as follows:



It causes the first letter S to sink from the fourth through the fifth to the sixth position and the letter T to sink from the seventh to the eighth position.

Having completed the second pass you can disregard the bottom two positions, and so the third pass may be shown thus:

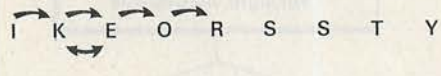


Here, the letter R sinks from the third through the fourth to the fifth position. The bottom three positions may now be disregarded.

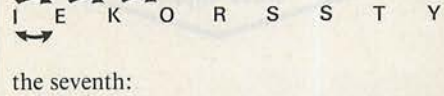
You can see that a sorted sequence is being built up from the bottom position upwards, each pass adding one position to the sorted sequence. Further passes take place as follows:

the fourth

the fifth

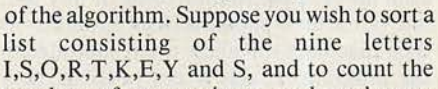


the sixth:



the seventh:

the eighth:



After the eighth pass no passes can be made; in terms of the algorithm PB = 1. The list must now be in order. The total number of comparisons is

$$8+7+6+5+4+3+2+1=36$$

and the total number of exchanges is

$$5+3+2+2+1+1+0+0=14$$

The list has, in fact been in order since the end of the sixth pass, so the method is not a very efficient one.

In order to assess the efficiency of this method it is necessary to work out the minimum and maximum numbers of comparisons and exchanges which could occur. In the case of comparisons, the same number will be made in all situations. For N keys, there will be N − 1 comparisons in the first pass, N − 2 in the second, and so on down to 1 in the last. The total number of comparisons is then $N*(N-1)/2$.

The minimum number of exchanges occurs when the list is already in order, and is 0. The maximum number occurs when the list is in reverse order in which case every comparison will result in an exchange, giving rise to $N*(N-1)/2$ exchanges.

It is immediately clear that even if the list is already in order, the method still makes as many comparisons as it would if the list were in reverse order. Furthermore, in all cases except that of a completely reversed list, the keys will become ordered before all the passes have been completed.

A sorted list can be recognised by the fact that on passing through it no exchanges need to be made. So you can use a logical flag to record whether or not any exchanges took place on the previous pass to decide whether to embark on another pass or to stop.

The algorithm in figure 2 reflects the change. It includes an additional variable:

PF — pass flag, which records whether or not an exchange has occurred

Because of the way the flag is used in step 12 it will have to be declared as being of integer type rather than of logical or Boolean type, even though it takes only two values 0 and 1. If PF = 1 then the effect of step 12 is, as in the original algorithm, PB: = PB − 1. If

(continued on page 122)

Andrew Featherstone is a software engineer with British Aerospace; this article is based on work done by the author as part of an HND project at Oxford Polytechnic.

Figure 1.

```
(1)   PB: = NK
(2)   repeat          (3)   PP: = 2
                      (4)   repeat          (5)   if K$(PP – 1) > K$(PP)
                                                  then (6) T$: = K$(PP)
                                                       (7) K$(PP): = K$(PP – 1)
                                                       (8) K$(PP – 1): = T$
                                            (9)   PP: = PP + 1
                            until PP > PB
                      (10)  PB: = PB – 1
      until PB < 2
```

Figure 2.

```
(1)   PB: = NK
(2)   repeat          (3)   PF: = 0
                      (4)   PP: = 2
                      (5)   repeat          (6)   if K$(PP – 1) > K$(PP)
                                                  then (7) T$: = K$(PP)
                                                       (8) K$(PP): = K$(PP – 1)
                                                       (9) K$(PP – 1): = T$
                                                       (10)PF: = 1
                                            (11)  PP: = PP + 1
                            until PP > PB
                      (12)  PB: = PB * PF – 1
      until PB < 2
```

Figure 3.

```
(1)   PB: = NK
(2)   repeat          (3)   PF: = 0
                      (4)   PP: = 2
                      (5)   repeat          (6)   if K$(PP – 1) > K$(PP)
                                                  then (7) T$: = K$(PP)
                                                       (8) K$(PP): = K$(PP – 1)
                                                       (9) K$(PP – 1): = T$
                                                       (10)PF: = 1
                                            (11)  PP: = PP + 1
                            until PP > PB
                      (12)  PB: = PF – 1
      until PB < 2
```

Figure 4.

```
(1)   PT: = 2
(2)   PB: = NK
(3)   PF: = 0
(4)   repeat          (5)   PP: = PT
                      (6)   repeat          (7)   if K$(PP – 1) > K$(PP)
                                                  then (8) T$: = K$(PP)
                                                       (9) K$(PP): = K$(PP – 1)
                                                       (10) K$(PP – 1): = T$
                                                       (11) PF: = PP
                                            (12)  PP: = PP + 1
                            until PP > PB
                      (13)  PB: = PF – 1
                      (14)  if PB ≧ PT
                            then            (15)  PP: = PB
                                            (16)  repeat  (17)  if K$ (PP – 1) > K$(PP)
                                                                then (18)  T$: = K$(PP)
                                                                     (19)  K$(PP): = K$(PP – 1)
                                                                     (20)  K$(PP – 1): = T$
                                                                     (21)  PF: = PP
                                                          (22)  PP: = PP – 1
                                                  until   PP < PT
                                            (23)  PT: = PF + 1
      until PB < PT
```

Exchange sort.

```
1100 REM STRAIGHT EXCHANGE SORT
1101 LET PB=NK
1102 LET PP=2
1103 IF K$(PP-1)<=K$(PP) THEN GO
TO 1107
1104 LET T$=K$(PP)
1105 LET K$(PP)=K$(PP-1)
1106 LET K$(PP-1)=T$
1107 LET PP=PP+1
1108 IF PP<=PB THEN GOTO 1103
1109 LET PB=PB-1
1110 IF PB>=2 THEN GOTO 1102
1111 RETURN
```

Logical ripple sort.

```
1200 REM LOGICAL RIPPLE SORT
1201 LET PB=NK
1202 LET PF=0
1203 LET PP=2
1204 IF K$(PP-1)<=K$(PP) THEN GO
TO 1209
1205 LET T$=K$(PP)
1206 LET K$(PP)=K$(PP-1)
1207 LET K$(PP-1)=T$
1208 LET PF=1
1209 LET PP=PP+1
1210 IF PP<=PB THEN GOTO 1204
1211 LET PB=PB*PF-1
1212 IF PB>=2 THEN GOTO 1202
1213 RETURN
```

Integer ripple sort.

```
1300 REM INTEGER RIPPLE SORT
1301 LET PB=NK
1302 LET PF=0
1303 LET PP=2
1304 IF K$(PP-1)<=K$(PP) THEN GO
TO 1309
1305 LET T$=K$(PP)
1306 LET K$(PP)=K$(PP-1)
1307 LET K$(PP-1)=T$
1308 LET PF=PP
1309 LET PP=PP+1
1310 IF PP<=PB THEN GOTO 1304
1311 LET PB=PF-1
1312 IF PB>=2 THEN GOTO 1302
1313 RETURN
```

Shaker sort.

```
1400 REM SHAKER SORT
1401 LET PT=2
1402 LET PB=NK
1403 LET PF=0
1404 LET PP=PT
1405 IF K$(PP-1)<=K$(PP) THEN GO
TO 1410
1406 LET T$=K$(PP)
1407 LET K$(PP)=K$(PP-1)
1408 LET K$(PP-1)=T$
1409 LET PF=PP
1410 LET PP=PP+1
1411 IF PP<=PB THEN GOTO 1405
1412 LET PB=PF-1
1413 IF PB<PT THEN GOTO 1423
1414 LET PP=PB
1415 IF K$(PP-1)<=K$(PP) THEN GO
TO 1420
1416 LET T$=K$(PP)
1417 LET K$(PP)=K$(PP-1)
1418 LET K$(PP-1)=T$
1419 LET PF=PP
1420 LET PP=PP-1
1421 IF PP>=PT THEN GOTO 1415
1422 LET PT=PF+1
1423 IF PB>=PT THEN GOTO 1404
1424 RETURN
```

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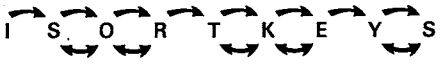
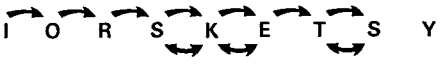
PF = 0 then its effect is PB: − 1. PB becomes less than 2, so the condition PB < 2 holds and another pass is not started.

The same simple example as before will illustrate the difference in the working of the changed algorithm. Each pass takes place as follows:

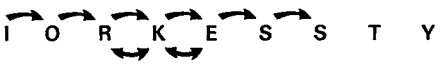
First pass



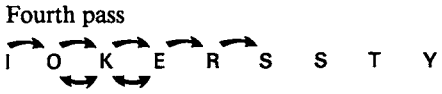
Second pass



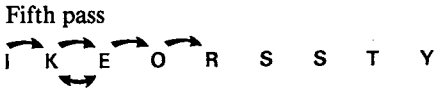
Third pass



Fourth pass

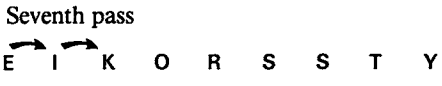


Fifth pass



Sixth pass

Seventh pass



No exchanges were made in the seventh pass and so the list must now be in order; in terms of the algorithm PB = − 1. The total number of comparisons is 35 and the total number of exchanges is 14.

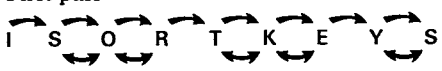
In this example the revised algorithm has detected that an eighth pass would be superfluous and so saved itself from making an unnecessary comparison. The change has therefore increased the efficiency of the method by reducing to the minimum the number of comparisons. If given an ordered list of keys, this method will run through them once and then stop, having made N − 1 comparisons. The maximum number of comparisons remains N*(N − 1)/2. The minimum and maximum numbers of exchanges remain the same, 0 and N *(N − 1)/2 respectively.

In the general case, rather than the best case of the ordered list or the worst case of the reversed list, some reduction in the number of comparisons almost always results. Yet the method is still not as efficient as it could be. Suppose that somewhere in the middle of the process a pass has just been completed somewhere near the bottom of the list during which the last exchange took place somewhere near the top of the list. An exchange having occurred, another pass commences to run from the top of the list down to the element which was the last but one in the previous pass. Since the last exchange occurred somewhere near the top of the list, all the elements from then on must have been in order, and the comparisons made by the new pass after the element at which the last exchange took place are unnecessary.

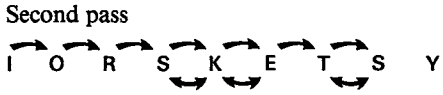
By making the flag introduced in the last method an integer variable rather than a logical one it can be used to record the position at which an exchange takes place. So at the end of a pass the flag will hold the position at which the last exchange occurred. The algorithm in figure 3 demonstrates this new use. The variables are as before except that PF now takes integer values other than 0 and 1.

Using the previous example, the working of the new algorithm can be illustrated as follows:

First pass



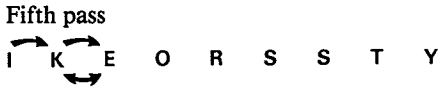
Second pass



Third pass

Fourth pass

Fifth pass



Sixth pass

In the sixth pass the last exchange was between positions two and one — in terms of the algorithm PB = 1 — and so the list must now be in order. The total number of comparisons is 27 and the total number of exchanges is 14. The revised algorithm does not embark on an unnecessary seventh pass, and has thereby saved two comparisons. It also saves two unnecessary comparisons on each of the fourth, fifth and sixth passes. The efficiency of the method is therefore increased by the change.

At first sight there appears to have been no improvement in efficiency: the minimum and maximum numbers of comparisons remain unchanged at N − 1 and N*(N − 1)/2 respectively, and the same goes for the minimum and maximum number of exchanges at 0 and N*(N − 1)/2 respectively. In the general case, however, a good reduction in the number of comparisons does follow from the change.

Yet there is still room for further improvement. Suppose you have a list of keys which are all in order except that the heaviest key is at the top end. The method will sort this list in one pass, during which the offending key will sink from the top to the bottom. So far, so good.

Now suppose you have a list of keys which are all in order except that the lightest key is at the bottom end. After one pass the method will have moved the offending key up by one element, and so to move the key to the top requires almost as many passes as there are keys. If passes ran not from top to bottom but from bottom to top the first case would need many passes and the second only one. Rather than scanning in one direction only each time, the direction of scan can be alternated so that each pass consists of a scan in one direction followed, if necessary, by a scan in the other. This method is known as the shaker sort.

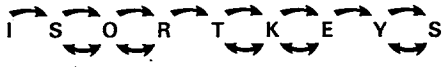
Figure 4 gives an algorithm for the shaker sort. There is one new variable:

PT — pass top, indicating the element at which the current upward-running scan is to stop, complementary to PB

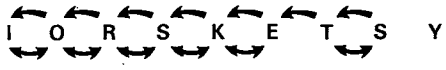
Steps 5 to 13 are the old downward scan; steps 15 through 23 are the new upward scan. Step 14 prevents the upward scan taking place if the downward scan has found that the list has been sorted. The effect of the process is to cause sorted heavy keys to accumulate in the bottom end of the list and sorted light keys to accumulate in the top. The sort is complete when the sets of sorted keys in the ends meet in the middle — that is, when PB and PT have crossed.

Using ← to represent comparisons in the upward scan the shaker sort acts on the previous example as follows:

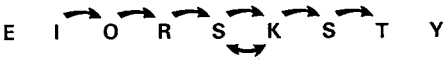
First pass



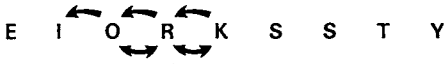
Second pass



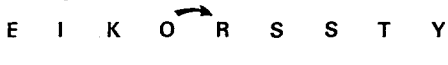
Third pass



Fourth pass



Fifth pass



At the end of the fifth pass PB is less than PT, so the list is now in order. The total number of comparisons is 25 and the total number of exchanged is 14. In this instance the algorithm has reduced the number of comparisons by two.

The minimum and maximum number of comparisons and exchanges are unchanged by the new method: N − 1 and N*(N − 1)/2 for comparisons; 0 and N*(N − 1)/2 for exchanges. In the general case an appreciable reduction in the number of comparisons is usually achieved, though a possibility of unnecessary comparisons occurring still remains.

Suppose that during an upward scan a light key is picked up, which comes to rest towards the top of the sorted sequence of keys which has grown at the top end of the list, so that there is a number of sorted keys below it. The next downward scan now starts from the element below the new arrival, running down through the sorted sequence below it and making comparisons which are unnecessary. A better place to start the downward scan would have been at the bottom of the sorted sequence, and the same applies to the complementary situation at the other end. ◻

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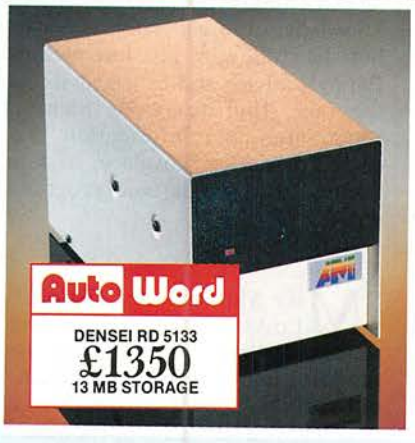

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MONKEYNUT MYSTERY

by Peter van der Linden

"What?" roared the irate voice at Mike Multics the operations manager, who was nervously shuffling his feet. "Here I am negotiating bonus monkeynut sacks for my DP staff, and you come in whining about disc drives going down." The office door, sprawlingly labelled T Watson, DP Manager, was quivering under the outburst almost in sympathy with the operations manager within. "And stop shuffling your feet."

The little operations manager stilled his feet and tried again. "I wouldn't normally bother you, Mr Watson. It's just that George Fore, my night-shift operator, was underneath the disc drive when it went down. It fell on him. He's been squashed as flat as day-old beer. He's as dead as a dodo. Mind you, the drive looks OK — we'll soon wipe the stickiness off it and have it back in service. Er, will that be all?" Multics finished hopefully.

Watson rolled his eyes in frustration. For the umpteenth time he wondered why he had ever accepted the job of DP manager with Mighty Marvin's Marvellous Monkeynuts Ltd. After all, 4M, as it was known in the trade, had quite a reputation for employing, well, nutty DP staff. Watson inwardly wished he had followed his grandfather and father into the family business, selling Itty-Bitty Machines from a stall in the Saturday market. Outwardly, he stifled his immediate urge to fire the operations manager, and reached for the telephone instead.

Two hours later the last worldly remains of George, the squashed operator, has been neatly scooped up and decanted into jam jars. Watson turned round to find a rotund individual with a tatty ginger beard surveying him coolly.

"My card," said the stranger, presenting it with a grandiose flourish. "The agency sent me. I believe I may be of some assistance to you."

Watson took the proffered item and examined the finely engraved script. It read: "A P L Byteswap, Computer Consultant. Bugs located." Watson idly turned it over, and noticed that the reverse was also engraved: "A P L Byteswap, Private Detective. Locations bugged."

The DPM made a quick decision. "Alright," he said, "Find out what happened, and I'll pay agency rates plus two sacks of monkeynuts."

"Done" agreed Byteswap, who would have been willing to settle for the agency rate plus one sack.

"Will you want to examine the body?" enquired Watson, indicating a row of jam jars containing what appeared to be cranberry sauce. Byteswap declined with a fastidious grimace, but asked to interview the finder. Multics was escorted into the room between two burly data prep supervisors.

"Did George Fore have any enemies?" queried Byteswap.

Multics was plainly annoyed. "What does it matter if he did? He was found locked in the machine room, with the only key in the door on his side. We had to break the door down to get in before we even knew what all the noise was."

Byteswap frowned. It was going to be a long investigation, till teatime at least and perhaps the best part of tomorrow morning as well. There was only one possible way of speeding up the inquiry and getting all those monkeynuts in time for the weekend: Byteswap would consult the Pre-antipenultimate One.

The PO was an artifically intelligent program which could only be run from a smart Japanese terminal. The unusual name stemmed from the time it had proved Fermat's fourth-to-last theorem. It was at least 57th generation by now, as Byteswap had been working on it haphazardly for several years.

It had started life as a combined syntax editor and pattern matcher, but Byteswap had elegantly bootstrapped it up. He had incorporated more and more features in each version, until it had evolved into a general-purpose problem solver. It used to spend a lot of time upgrading itself, until eventually it became bored.

Nowadays its only fault seemed to be a distressing, atavistic tendency to lisp. If Pappy, as Byteswap lovingly referred to it, was disposed to talk to him, he would surely soon have the answer to the mystery.

"Cherchez la femme," lisped Pappy tendentiously. "Honi soit qui mal y pense," and obstinately refused to discuss the matter further until Byteswap installed an extra megabyte of memory. Byteswap's knowledge of foreign languages was small, but he followed his interpretation of Pappy's advice and collected six slaps on the face, four telephone numbers and some interesting information. The last came from Miss Lovelace, a statuesque brunette who was the chief programmer at 4M.

"Mike Multics killed George," Miss Lovelace confided in breathless tones. "George and Mike were rivals for my affections. I knew one of them would kill the other sooner or later. Men do that over me, you know. I suppose Mike will go to prison, and poor Goerge is no more. Who will look after me now?"

Miss Lovelace poignantly leaned towards Byteswap, fluttering her soft eyelashes. Byteswap turned

three shades of red, coughed nervously and suddenly remembered an urgent appointment elsewhere. Things were getting out of hand, he decided.

Byteswap drove straight to the Watsons' market stall. "Another insoluble case?" old Mr Watson jeered, as they strapped the memory boards on to the back of Byteswap's motorcycle. At home, Byteswap speedily installed the memory upgrade and powered up the system.

Pappy came straight to the point. "It's quite thimple" the oracle rumbled. "Miss Lovelace killed George Fore. She did it out of hatred of the operations. department, caused by too many late-night call outs."

Byteswap listened avidly as the machine thundered on.

"The modus operandi was also thimple. Lovelace wrote a two-stage program, to drive the disc which crushed George. The first stage merely set the disc-status light on and called for operator attention. When the luckless operator came over and pressed the reset button, it triggered the second part of her program. It repeatedly accessed the outer track of the highest disc at a furious pace.

"Lovelace had previously loosened the disc fastenings, and after a second or two the tremendous pounding of the disc head destabilised the entire unit. It toppled forward and made cranberry sauce out of poor George Fore."

Incredulous, Byteswap inquired how Pappy had reached this solution.

"Bah! Xyzzy! Thimple! I asked the 4M mainframe," was the scornful reply. "And I've already shopped Lovelace direct to the Police National Computer, Interpol, Fore Meade, and GCHQ Cheltenham. The criminal! That disc unit could have been permanently damaged."

Byteswap roared back to 4M to claim his coveted monkeynuts. As he arrived Miss Lovelace was being ushered into a police van. She was fluttering her eyelashes at the sergeant, and Byteswap faintly overheard her plaintively asking him who would look after her now.

Inside the 4M factory Watson welcomed Byteswap into his office, where the tubby detective outlined the whole incredible story. The grateful DPM immediately tossed Byteswap the promised monkeynut bags and promised to cancel night-shift operations and programmer call outs immediately.

"I imagine this must have been the trickiest case you've ever solved?" Watson suggested.

Byteswap chuckled reprovingly, "No, no," he contradicted, mentally suppressing Pappy's role. "That distinction belongs to the events surrounding the tragic demise of old Professor "Pop" Stacks, who choked to death on a fission chip. Nobody knew the cause of death until I discovered that Stacks had been nibbling a 64K RAM chip."

"Great heavens!" exclaimed Watson. "What a tragedy." "I'll say," agreed Byteswap. "64K RAM chips were scarcer than hen's teeth at the time."

"But how did you ever establish the cause of Stacks' death?" persevered the DPM.

Byteswap smiled inscrutably. "Alimentary, my dear Watson," he replied and popped another marvellous monkeynut into his mouth.

Enveloped by BBC sounds

David Peckett's program makes learning to use the BBC Envelope and Sound commands easier.

THE BBC MICRO has an exceptionally powerful noise-generation facility. Three tone generators, a white-noise source and the Envelope command together make for a system that can do almost anything from providing laser zaps to playing Wagner as a three-part harmony. But to make even one channel produce a complex sound involves setting up no less than 18 parameters — 14 for Envelope and four for the Sound — many of which interact in subtle ways.

This program makes the sound commands easier to understand by allowing you to change one or more parameters and listen to its effect immediately, without having to type in all the others at the same time. That in itself is useful, but the program makes life even easier by drawing the pitch and amplitude envelopes on the screen for you. You can change a parameter, see immediately how it should alter the sound, adjust it if that is not correct and listen to the result whenever you like.

The program splits the screen into two parts. The lower third shows the Envelope and Sound statements with all their parameters. The top of the screen is taken up by a graphics display of the pitch and amplitude envelopes generated by those statements. The graphs only show the first five seconds of any sound; for the program to fit into a 32K machine, no room is available to make it adjust the time scale automatically. In practice, five seconds is plenty long enough to see and hear how a sound behaves.

The graphs are scaled vertically from 0 to 255, and the two envelopes appear on the same axes; the BBC Micro defines frequencies as being from 0 to 255 and amplitudes from 0 to 126. To make it easy to tell the two graphs apart, the pitch envelope is drawn in red and that for the amplitude in yellow; against a cyan background colour both are perfectly clear in colour and in monochrome.

The program cannot actually control all 18 of the parameters in the Envelope and Sound statements. Since it automatically sets up Envelope 1 and uses Sound channel 1 to make the noise, there is no point in altering these three parameters, which do not alter the sound anyway. Any of the remaining 15 may be altered independently of each other by using the Left and Right Arrow keys to position the cursor and typing in the desired value. All the values are checked and the program will prevent you setting any value out of range.

The program can be instructed to update the graphs automatically every time you alter a parameter or — shades of VisiCalc — only when you wish to. The mode selected is displayed by a H for Hold, or I for Immediate in the top right of the

Table 1. Main program areas.

Lines 140-250	format the screen.
Lines 260-370	define the system variables.
Lines 50-660	are the heart of program, selecting the next operation to be performed.
Lines 700-790	perform cursor control
Lines 1070-1420	scan the keyboard, read in a number, keeping it in the correct space, and check it for validity. If it is correct the sytem is updated, otherwise the old value is retained.
Lines 1450-1480	make the noise.
Lines 1640-2220	draw the amplitude envelope.
Lines 1760-1870	draw the attack phase.
Lines 1900-2000	draw the decay phase if needed.
Lines 2030-2110	draw the sustain phase, if needed.
Lines 2140-2220	draw the release phase, if anything left.
Lines 2250-2790	draw the pitch envelope.
Lines 2330-2370	handle pitch autorepeat.
Lines 2600-2710	handle the case of the pitch trying to go past 0 or 255 and wrap it round as necessary.

BBC sound demonstration program.

```
L.
   10 REM** ENVELOPE and SOUND demos
   20 REM** 14-11-82. by David Peckett
   30 MODE1
   40 DIM Pm(18),XPm(18),YPm(18),PmSize(
1,18),Sequence(19)
   50 PROCInit:REM** Set things up
   60 PROCEnv_and_Snd
   70 PROCMain:REM** Do it
   80 *FX4
   90 CLS
  100 END
  110
  120 REM** Set up the display
  130 DEF PROCInit
  140 VDU 28,0,31,39,26:REM** Text area
  150 VDU 19,0,6;0;19,3,0;0;:REM** Re-de
fine cols
  160 CLG
  170 GCOL 0,3
  180 MOVE 1200,239:DRAW 111,239:DRAW 11
1,1050:REM** Draw axes
  190 VDU 5
  200 MOVE 100,230:PRINT "0":MOVE 563,23
0:PRINT"2.5":MOVE 1095,230:PRINT"5":MOVE
 71,250:PRINT"0":MOVE 7,639:PRINT"128":M
OVE 7,1023:PRINT"255"
  210 MOVE 770,230:PRINT "<secs>"
  220 VDU 24,112;240;1279;1023;29,112;24
0;:REM** New graphics area
  230 Hold=TRUE:MOVE 1132,780:PRINT"H":
REM** Mark starting value
  240 VDU 4
  250 COLOUR 131:COLOUR 2:CLS
  260 FOR I%=1 TO 18:Pm(I%)=0:NEXT
  270 Pm(1)=1:Pm(2)=1:Pm(15)=1:Pm(16)=1:
REM** Starting values for parameters
  280 FOR I%=1 TO 19:READ Sequence(I%):
NEXT:REM** Sequence for cursor moves
  290 FOR I%=1 TO 18:READ XPm(I%),YPm(I%
):NEXT:REM** Screen pos of each
  300 FOR I%=1 TO 18:READ PmSize(0,I%),P
mSize(1,I%):NEXT:REM** Limits
  310 *FX 4,1
  320 Xpix=2:REM** X steps/10msecs
  330 Vpix=3:REM** V steps/unit
  340 REM** Data for arrays
  350 DATA 2,2,3,4,5,6,7,8,9,10,11,12,13
,14,17,14,17,18,18:REM** Parameter seq
  360  DATA 0,2,5,2,10,2,15,2,20,2,25,2,
30,2,35,2,0,3,5,3,10,3,15,3,20,3,25,3,6,
5,11,5,16,5,21,5:REM** Param pos'ns
  370 DATA 1,1,1,255,-128,127,-128,127,-
128,127,0,255,0,255,0,255,-127,127,-127,
127,-127,0,-127,0,0,126,0,126,1,1,1,1,0,
255,0,255:REM** Range of each param
  380 ENDPROC
  390
  400 REM** Print the ENVELOPE and SOUND
 Parameters
  410 DEF PROCEnv_and_Snd
  420 CLS
  430 PRINT '"ENVELOPE":
  440 PRINT TAB(0,5) "SOUND";
  450 FOR I%=1 TO 18
  460   PRINT TAB(XPm(I%),YPm(I%));: LEFT
$(STR$(Pm(I%))+"    ",4);:REM** Value
  470   IF (I%<>14) AND (I%<>18) PRINT",
";
  480   NEXT
  490 PRINT TAB(XPm(2),YPm(2));:REM** Se
t cursor
  500 CurPm=2
  510 ENDPROC
  520
  530 REM** Program core
  540 DEF PROCMain
  550 REPEAT
  560   Key=INKEY(0)
  570   IF Key=13 PROCZero:REM** CR for
zero
  580   IF Key=32 PROCNoise:REM** Space
  590   IF (Key>47 AND Key<58) OR (Key=4
5 AND PmSize(0,CurPm)<0) PROCNumber
  600   IF Key=72 PROCHold:REM** "H" for
 HOLD
  610   IF Key=73 PROCImmed:REM** "I" fo
r IMMEDIATE
  620   IF Key=83 SOUND 17,0,0,1:REM** "
S" to stop sound
  630   IF Key=85 AND Hold PROCDGraphs:R
EM** "U" to update the graphs
  640   IF Key=136 PROCLeft:REM** Left a
rrow
  650   IF Key=137 PROCRight:REM** Right
 arrow
  660   UNTIL Key=81:REM** "Q"
  670 ENDPROC
  680
  690 REM** Move cursor right
  700 DEF PROCRight
  710 CurPm=Sequence(CurPm+1)
  720 PRINT TAB(XPm(CurPm),YPm(CurPm));
  730 ENDPROC
  740
  750 REM** Move cursor left
  760 DEF PROCLeft
  770 CurPm=Sequence(CurPm-1)
  780 PRINT TAB(XPm(CurPm),YPm(CurPm));
```

graphics screen. The noise can be generated at any time by pressing the space bar.

The program contains Rems to show its main features but since it is a tight fit in 32K some further notes are needed to elaborate on its opeation. Table 2 shows the main variables in the program. In the program itself global variables have names starting with capital letters, while local variables start with lower case. The main areas of the program are as shown in table 1, which appears opposite.

At the start of the program ProcInit sets up the screen to separate the graphics and text windows and fills the arrays which control the input and positioning of the parameters shown at the bottom of the screen. It also sets the Hold flag to show that the graphics area should only be updated at the operator's request and not when each parameter is altered.

ProcMain is the heart of the program, reading the keyboard to see what to do next and selecting the appropriate function procedures to do it. It offers the following basic choices:

Position the cursor by way of the Left and Right Arrow keys.
Set the selected parameter directly to zero, or enter any desired value into it.
Make the sound.
Stop a sound which may be running on too long.
Set the Hold mode so that the graphs are only updated when U is pressed — this is useful if you wish to alter several parameters in one go.
Select the Immediate mode to change the graphs every time that a parameter is altered. In this mode the U key does nothing.
Finally, to exit the program press Q for Quit.

Numbers are input via ProcNumber, which only takes note of the numeric keys < and — if it is the first character. It allows a maximum of four characters to be entered, since this is the size of the parameter fields in the displayed Envelope and Sound statements and is terminated by pressing the Return key. If a number outside the possible range for that parameter is input, it is ignored and the original value is retained and redisplayed.

Table 2. Main program variables.

Pm(18)	array holding the current value of each Envelope and Sound parameter
XPm(18)	x-position of each parameter in text window
YPm(18)	y-position of each parameter in text window
PmSize(1,18)	maximum and minimum permitted values of each parameter
Sequence (19)	array showing the order in which the cursor should address the displayed parameters
AmpOK	flag used to control the effects of unusual amplitude-control parameters
CurPm	the number of the parameter to which the cursor is pointing
Durn	the total duration of the note, defined in screen co-ordinates
Hold	flag for graphics updates
I%	general-purpose counter
Key	ASCII value of the last key pressed
N$	string representation of an input number
PtchOK	flag used to control effect of zero length PN1-PN3
Xpix	number of x-co-ordinate steps per 0.01s.
Ypix	number of y-co-ordinate steps per y-axis unit
Xstep	number of x-co-ordinate steps per time unit
X1, Y1	last position of graphics cursor
Xa, Ya	graphics start position for each line when drawing pitch envelope
Xrel, Yrel	relative graphics cursor movement

Nearly half of the program is concerned with actually drawing the graphs, a procedure which starts simply with ProcGraphs calling ProcErase to clear the screen. ProcAmpl then draws the amplitude envelope, at the same time setting up the variables Xstep and Durn for later use when the frequency envelope is drawn. It is particularly important to calculate the sound's duration before drawing the frequency envelope since the release phase of the sound will often extend the duration beyond that defined by the fourth parameter, D, of the Sound command.

Each of the four phases of the amplitude envelope is drawn by its own procedure, consisting mainly of complex If-Then-Else statements. This construction is forced on the program by the many different possibilities generated by the complex nature of the Envelope statement. For instance, what if the sustain phase tries to take the amplitude below zero? Alternatively, what if the change of amplitude per step in the decay phase, AD, tries to take the amplitude in the opposite direction to the desired target level, ALD?

The *Users' Guide* does not explain at all clearly what happens in some of these more complex cases; the program is the end result of a lot of trial and error as to what actually goes on. For instance, if AD is going in the opposite direction to ALD, the sound's amplitude jumps straight to ALD and does not ramp to it.

Once it has drawn the amplitude envelope, the program can go on to draw the pitch envelope, since it now knows exactly how long the sound is to last. The core of this part of the program is at lines

(continued on page 129)

```
790 ENDPROC
800
810 REM** Update flag to HOLD
820 DEF PROCHold
830 PROCSetFlag
840 PRINT"H"
850 VDU 4
860 Hold=TRUE
870 ENDPROC
880
890 REM** Clear the update flag
900 DEF PROCImmed
910 PROCSetFlag
920 PRINT"I"
930 VDU 4
940 Hold=FALSE
950 ENDPROC
960
970 REM** Common parts for PROCHold an
d PROCImmed
980 DEF PROCSetFlag
990 VDU 5:REM** Join cursors
1000 GCOL 3,3
1010 MOVE 1132,780:REM** for right
1020 IF Hold THEN PRINT "H" ELSE PRINT
"I":REM** Clear whatever's there
1030 MOVE 1132,780:REM** Reset cursor
1040 ENDPROC
1050
1060 REM** Read a number
1070 DEF PROCNumber
1080 LOCAL len,nkey$
1090 N$=CHR$(Key)
1100 len=1
1110 PRINT N$;
1120 REPEAT
1130   nkey$=GET$
1140   IF (nkey$>="0" AND nkey$<="9" AN
D len<4) OR (nkey$="-" AND len=0) N$=N$+
nkey$:len=len+1:PRINT nkey$;:REM** Valid
 key?
1150   IF ASC(nkey$)=127 AND len>0 len=
len-1:N$=LEFT$(N$,len):PRINT nkey$;:REM*
* Delete?
1160   UNTIL ASC(nkey$)=13:REM** CR
1170 IF N$="" OR N$="-" N$="0":REM** Fo
rce zero
1180 PROCNumValid:REM** Ok ?
1190 PROCUpdate
1200 ENDPROC
1210
1220 REM** Force a zero value
1230 DEF PROCZero
1240 IF CurPm=2 THEN N$="1" ELSE N$="0"
1250 PROCUpdate
1260 ENDPROC
1270
1280 REM** See if a number is valid
1290 DEF PROCNumValid
1300 LOCAL valid,num
1310 num=EVAL(N$)
1320 valid=num>=PmSize(0,CurPm) AND num
<=PmSize(1,CurPm):REM** In range?
1330 IF NOT valid N$=STR$(Pm(CurPm)):VD
U 7:REM** Keep what we've got
1340 ENDPROC
1350
1360 REM** Update the value
1370 DEF PROCUpdate
1380 Pm(CurPm)=EVAL(N$):REM** New value
1390 PRINT TAB(XPm(CurPm),YPm(CurPm)) L
EFT$(N$+"    ",4);
1400 IF NOT Hold PROCDrawGraphs:REM** Upda
te?
1410 PROCRight:REM** Next parameter
1420 ENDPROC
1430
1440 REM** Make sound
1450 DEF PROCNoise
1460 ENVELOPE Pm(1),Pm(2),Pm(3),Pm(4),P
m(5),Pm(6),Pm(7),Pm(8),Pm(9),Pm(10),Pm(1
1),Pm(12),Pm(13),Pm(14)
1470 SOUND Pm(15),Pm(16),Pm(17),Pm(18)
1480 ENDPROC
1490
1500 REM** Update graphs
1510 DEF PROCDrawGraphs
1520 PROCErase
1530 PROCDrawAmpl:PROCDrawPitch
1540 ENDPROC
1550
1560 REM** Clear graphics
1570 DEF PROCErase
1580 CLG
1590 PROCSetFlag:REM** Restore Hold mar
ker
1600 VDU 4
1610 ENDPROC
1620
1630 REM** Amplitude envelope
1640 DEF PROCDrawAmpl
1650 GCOL 0,2
1660 MOVE 0,0
1670 Xstep=(Pm(2) MOD 128)*Xpix:REM** X
move per time step
1680 Durn=FNMin(1000,Pm(18)*5*Xpix):REM
** Duration
1690 PROCAttk
1700 IF AmpOK PROCDec
```

(listing continued on next page)

BBC sounds

(listing continued from previous page)

```
1710 IF AmpOK PROCSust
1720 PROCRlse
1730 ENDPROC
1740
1750 REM** Attack Phase
1760 DEF PROCAttk
1770 LOCAL aa,ala,at
1780 AmpOK=TRUE
1790 aa=Pm(9)*Vfix
1800 ala=Pm(13)*Vfix:REM** To screen co
-ords
1810 IF aa>0 THEN at=ala*Xster/aa:REM**
Check there is an attack
1820 IF aa<=0 at=0:REM** Jump to it?
1830 IF at>Durn ala=ala*Durn/at:at=Durn
:AmpOK=FALSE:REM** Enough time left?
1840 IF aa=0 AND at=0 AND ala=0 AmpOK=F
ALSE:Durn=0:REM** False start?
1850 PLOT 1,at,ala:REM** Draw it
1860 X1=at:V1=ala:REM** Present Posn.
1870 ENDPROC
1880
1890 REM** Decay Phase
1900 DEF PROCDec
1910 LOCAL ad,ald,at
1920 ad=Pm(10)*Vfix
1930 ald=Pm(14)*Vfix:REM** Screen co-or
ds
1940 IF ad*(ald-V1)<0 OR (ad=0 AND ald>
V1) ad=378*SGN(ald-V1):REM** Is ramp in
correct direction?
1950 IF ad<>0 AND ald<>V1 THEN at=X1+(a
ld-V1)*Xster/ad ELSE IF ad<>0 AND ald=V1
THEN at=X1 ELSE at=Durn:ald=V1:AmpOK=FA
LSE:REM** Is it decaying?
1960 IF at>Durn ald=V1+(ald-V1)*(Durn-X
1)/(at-X1):at=Durn:AmpOK=FALSE:REM** Kee
p on screen
1970 PLOT 5,at,ald
1980 X1=at:V1=ald:REM** Update
1990 IF V1>0 Durn=X1:AmpOK=FALSE
2000 ENDPROC
2010
2020 REM** Sustain Phase
2030 DEF PROCSust
2040 LOCAL aa,ala,at
2050 aa=Pm(11)*Vfix
2060 at=Durn-X1:REM** Time left
2070 ala=V1+at*Xster:REM** Final lev
el
2080 IF ala<0 at=-at*V1/Xster:at=at+X1
:ala=0:Durn=X1+at:REM** Reached zero
early?
2090 PLOT 5,Durn,ala
2100 X1=Durn:V1=ala
2110 ENDPROC
2120
2130 REM** Release Phase
2140 DEF PROCRlse
2150 LOCAL ar,at
2160 ar=Pm(12)*Vfix
2170 IF ar=0 THEN at=1000-X1 ELSE at=V1
*Xster/ABS(ar):REM** How long?
2180 'IF V1=0 at=0:REM** Finished alread
y?
2190 at=FNMin(1000-X1,at):X1=X1+at:REM** Keep
on screen
2200 Durn=Durn+at:REM** Add release tim
e
2210 PLOT 1,at,ar+at,Xster
2220 ENDPROC
2230
2240 REM** Draw the Pitch envelope
2250 DEF PROCDrawPitch
2260 LOCAL ystart
2270 GCOL 0,1:REM** Select colour
2280 ystart=Pm(17)*Vfix:REM** Starting
freq
2290 X1=0:V1=ystart:REM** Start Pos.
2300 MOVE X1,V1
2310 I%=3
2320 PtchOK=TRUE
2330 REPEAT
2340   IF I%=3 AND PtchOK DRAW X1,ystar
t:V1=ystart:REM** Start of freq cycle
2350   IF (Pm(I%)=0 AND Pm(I%+3)=0) THE
N X1=Durn:DRAW X1,V1 ELSE PROCPline:REM*
* Level to the end of the sound?
2360   IF PtchOK I%=(I%+1) MOD 3 +3:REM
** Count 3-5 if non-zero step
2370   UNTIL X1>=Durn OR ((Pm(2) AND &8
0) AND I%=3 AND PtchOK):REM** Repeat fre
q. env.?
2380 IF (Pm(2) AND &80) DRAW Durn,V1:RE
M** If not repeat, level to end
2390 ENDPROC
2400
2410 REM** Pitch lines
2420 DEF PROCPline
2430 LOCAL xtemp,ytemp
2440 Xrel=Pm(I%+3)*Xster:REM** Relative
!!
2450 PtchOK=(Xrel<>0)
2460 IF NOT PtchOK Xrel=Xster:REM** Han
dle zero step length
2470 xtemp=FNMin(Xrel,Durn-X1):REM** Ke
ep on screen
2480 IF PtchOK THEN Pdmy=Pm(I%+3) ELSE
Pdmy=1:REM** Handle zero step length
2490 Yrel=Pm(I%)*Pdmy*Yfix*xtemp/Xrel:R
EM** Relative Y
2500 Xrel=xtemp
2510 Xa=X1:Ya=V1:REM** Start Pos.
2520 REPEAT
2530   ytemp=Ya+Yrel:REM** Target Y
2540   IF ytemp>767 THEN PROCPZiaZaa(TR
UE) ELSE IF ytemp<0 THEN PROCPZiaZaa(FAL
SE) ELSE PROCPstrt:REM** Allow for foldi
ng
2550   UNTIL Yrel=0
2560 X1=Xa:V1=Ya:REM** Where we end up
2570 ENDPROC
2580
2590 REM** Draw a folding Pitch line. U
p=TRUE shows going up
2600 DEF PROCPZiaZaa(Up)
2610 LOCAL xtemp,ytemp
2620 IF Up ytemp=767 ELSE ytemp=0
2630 ytemp=ytemp-Ya:REM** How far to sc
reen edge
2640 xtemp=Xrel*ytemp/Yrel:REM** Scale
X movement
2650 PLOT 1,xtemp,ytemp:REM** Draw to e
dge
2660 IF Up PLOT 1,0,-767 ELSE PLOT 1,0,
767:REM** To other edge
2670 Xa=Xa+xtemp
2680 Xrel=Xrel-xtemp
2690 IF Up Ya=0 ELSE Ya=767
2700 Yrel=Yrel-ytemp:REM** Update Point
ers
2710 ENDPROC
2720
2730 REM** Pitch if no foldback
2740 DEF PROCPstrt
2750 PLOT 1,Xrel,Yrel
2760 Xa=Xa+Xrel
2770 Ya=Ya+Yrel:REM** Adjust Pointers
2780 Yrel=0:REM** To end REPEAT
2790 ENDPROC
2800
2810 REM** Find the min of 2 numbers
2820 DEF FNMin(a,b)
2830 LOCAL dummy
2840 dummy=a
2850 IF b<a dummy=b
2860 =dummy
```


Two new cards to really

SCREENMASTER 80

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(continued from page 127)

2330 to 2370, which cycle repeatedly through the three pitch segments allowed by the Envelope syntax. Normally a sound will autorepeat its pitch envelope until its time runs out, but the program also checks the setting of bit 7 of the T parameter, held in Pm(2). If it is set, it disables the autorepeat. The envelope then cycles just once and the note stays constant at the final value if reached.

Autorepeating also ends if pitch durations PN1, PN2 or PN3 are zero. If so, the pitch of the generated noise simply advances by the value defined in the associated PIn at each time step. This is also not explained in the *Users' Guide,* but it gives a way of generating a note which is continually cycling its pitch. The zero PNn also overrides any autorepeat selection defined by bit 7 of the T parameter.

The changing frequency of each step in the pitch envelope is drawn by ProcPline, which in turn calls on ProcPZigZag and ProcPstrt to actually put the lines on the screen. ProcPZigZag takes care of the case where the pitch at the end of a given section wants to go below zero or above 255. In these cases, the actual pitch jumps from 0 to 255 or from 255 to 0 as it crosses the edge; the program must spot these jumps and draw appropriate lines. In the easy case of the pitch staying between 0 and 255 ProcPstrt simply draws a straight line.

Once you have entered the program, you will see a display of the starting Envelope and Sound parameters, most of which are zero, and a blank graphics screen with only the axes marked. You can enter data into any alterable parameter simply by positioning the cursor on it, using the Left and Right Arrow keys, and starting to type in the number, starting with a – sign or any digit. You may delete as normal and, when you are ready, press Return.

If the number you have entered is outside the permitted range of that parameter — see page 182 and 185 in the *Users' Guides* — the computer will beep and the original value will be restored. To set a value to zero, simply press Return when you position the cursor. Once each number has been correctly entered the cursor automatically moves on to the next alterable parameter.

If the system is in the Immediate Update mode, shown by an I at the top right corner of the screen, the graphs will be revised every time that you change a parameter. In Hold mode, when an H is on the screen, the update will not take place until you press U; whenever the program starts up it is automatically set to Hold. To select Hold, press H; Immediate is chosen by pressing the I key.

The note you have defined may be sounded at any time by pressing the space bar; to stop it press S. You can repeat the note as often as you like. Pressing Q will exit the program, while no other key has any effect.

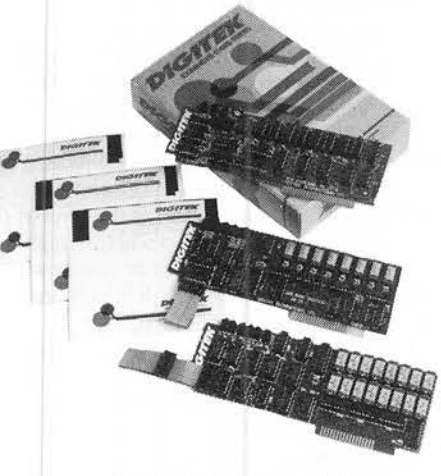
Although the program accurately displays the pitch and amplitude envelopes it has certain limitations. When it is first run, all the parameters are zeroed. You should put sensible values into them before you try to draw the graphs, otherwise there is a remote chance of a divide-by-zero error. Although error trapping is fairly thorough, there simply was not room to put full checks for every possible mistake into the program, but once you are past the start you will not have any problems from this area. Once running, the program will accept any legal value of any alterable parameter, even though some give unexpected results.

Secondly, the program draws each element of the two envelopes as a straight line, whereas the BBC Micro actually produces staircase changes of pitch and amplitude. With large values of the T parameter you can actually hear the individual steps, although the changes normally sound like the smooth lines drawn by the program and shown everywhere in the *Users' Guide* This slight simplification was chosen simply to ensure that the program drew the graphs quickly; originally it drew steps, but was very slow for small values of T.

Finally, the program only draws the first five seconds of any note, although it sounds the full duration. This is a compromise chosen to fit the program into 32K while retaining Mode 1 graphics to give acceptable resolution. In practical terms, none of these limitations has much effect on the program, which is easy to use and gives an excellent idea of what is happening.

make your Apple blossom

RAMMASTER RANGE



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● Circle No. 184

Spectrum games

Jack Schofield tests six cassettes.

Space Raiders

FOR RAIDERS read invaders — this is a standard implementation of the popular pub/arcade game. In the Sinclair version from Psion, 55 aliens gradually work their way down the screen while you defend Earth.

The aliens come in five ranks and you have three bases to hide behind. There is also a mother ship moving slowly backwards and forwards at the top of the screen, which you can hit for a bonus.

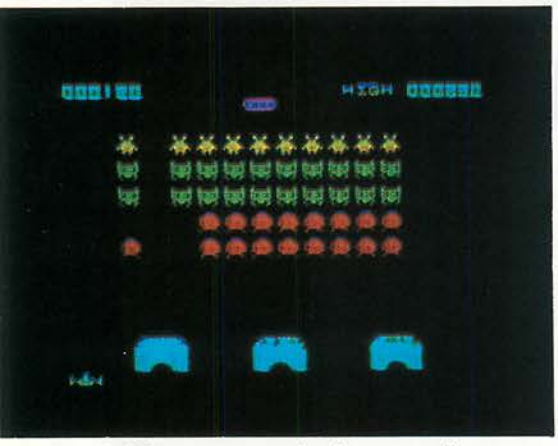
There are three major problems with this game. The first is a limitation of the Spectrum's design — you have to move your blaster backwards and forwards with the Z and X keys, and use the space bar to fire. The game would be much more fun to play using a joystick, and it seems strange that such a play-orientated micro does not have a joystick port.

The second problem is the sound, which is so feeble as to be hard to hear. Again it is a shame the Spectrum does not have more versatile sound facilities.

The third problem could be due to the nature of the machine or the program. The game runs incredibly slowly. Psion could have called the game Water Invaders, converting the aliens into jelly fish and the blaster into a minature crab — it would be more in line with the feel of the game.

Specification

Type: arcade game with barely audible sound
System: 16K or 48K Spectrum
Manufacturer: Psion for Sinclair
Price: £4.95
Rating: 6/20



Spectral Invaders

BUG-BYTE'S VERSION of Space Invaders is very similar to Psion's, as you would expect — though I cannot see anything particularly Spectral about the Bug-Byte aliens. The main advantage of the Spectral version is that it can be played by one or two players, the screen holding both scores. Unfortunately, you are asked to enter 1 or 2 for the number of players at the start of every game.

The Bug-Byte version also has five rows of 11 aliens, but in this case each row is a different colour. The animation of the aliens is more imaginative and they move in a more alien invader fashion. You have four bases to hide behind instead of three, although the Bug-Byte aliens demolish them rather more quickly than the Psion ones.

Blaster movement is controlled not with Z and X but with the Caps Shift and Z keys, the space bar again being used to fire. In both games the music is equally feeble. The Bug-Byte version has slightly better animation, but is rather more difficult to play. This is mainly because it is hard to see the alien bullets coming at you, which makes it hard to dodge them effectively.

The game is probaby adequate if you just want to have a version of Space Invaders to play at home but, frankly, playing it is not exactly gripping;

Specification:

Type: arcade game with colour and barely audible sound
Format: cassette tape
System: 16K or 48K Spectrum
Manufacturer: Bug-Byte Software, 98-100 The Albany, Old Hall Street, Liverpool L3 9EP
Price: £5
Rating: 7/20

Chess

ON LOADING, Psion's chess program displays an attractive blue screen with a black and yellow chess board. Numbers and letters are provided on all four sides for entering the moves in algebraic notation.

First you are given a choice of playing or setting up a particular position, then you choose white or black, then the level of play, from 0 to 9. You enter moves in the normal way, and the computer displays them during the game in columns labelled You and Me, showing up to 14 moves at a time. The computer gives a tiny beep on making a move.

Chess, or Master Chess as it says on the screen, plays a very good game even at level 3. It should challenge the vast majority of chess players — unless my own game has declined more than I thought.

The instructions are brief but to the point. The program offers a good range of facilities, including recommended moves which are suggested on request.

You can change the level of play, save the current game to cassette for reloading later or copy the complete screen to a printer. You can also use the cursor controls to set up a particular position. All round Psion has produced a good chess-playing game.

Specification:

Type: board game
Format: cassette tape
System: 48K Spectrum
Manufacturer: Psion for Sinclair
Price: £7.95
Rating: 15/20

The Chess Player

NOT WITHSTANDING the curious robot on the cassette cover this is a straightforward chess game. Quicksilva has dressed it up with a hysterical introduction: "The earth hung in the void, turning on its' (sic) axis basking in the sun. Thus far in its' life the earth had suffered no major discomforts," etc., etc. Anyway The Chess Player has produced a board from Dimension X and you are playing for the future of the Earth.

Unfortunately, the mass of words on the cassette label leave no room for simple instructions, such as how to operate the game. When questions appear on the screen, there is no guide as to how to answer them — although reasonably intelligent guesses such as P for play seem to work OK. When it asks for the level of play it gives no guidance to whether high numbers are better or worse or just how many levels there are, though it says on the cassette label there are six.

I tried level 1 to be told in large letters: "Ha Ha! You've no chance!" You do not always get the same message on the same level. On another game on level 1 I was told "This will be a tough match."

Later, in a straightforward Ruy Lopez, it responded to 3.B-N5 with "That was a good move". Fortunately it does not exclaim "Well that was really dumb!" if you throw your queen away.

The board appears against a black

background. The "black" squares are blue, and the "white" pieces are red. Though the graphics are quite attractive it is very difficult to see black pieces against blue squares, which gives the machine something of an unfair advantage.

The Chess Player displays only two moves on the board at once, and the total number of moves played. In other respects it is quite similar to Psion's Chess.

On level 1 The Chess Player plays very quickly at a passable but hardly inspired level. On level 6 I gave it 10 minutes to make its second move before abandoning the game. On level 3 most people will find a good compromise between the rate of play and the degree of difficulty.

It is not easy to say whether The Chess Player plays better than the Psion offering. Certainly it seems to have a slightly better grasp of strategy but this might be an illusion inspired by the fact that the Psion's Chess plays a more active and vigorous game. Perhaps the Quicksilva game seems more subtle.

In terms of screen presentation and convenience of use and number of features the Psion version scores. The worst thing about the Quicksilva game is the poor legibility of the board. For this reason I cannot rate it quite as highly, but it would undoubtedly keep the keen chess player amused.

Specification

Type: board game
Format: cassette tape
System: 48K Spectrum
Manufacturer: Quicksilva Limited, 92 Northam Road, Southampton SO2 0PB
Price: £6.95
Rating: 13/20

Hungry Horace

HUNGRY HORACE is an extremely silly game which is somewhat similar to Pacman. You are a small fat body with two black legs, and Horace is a goggle-eyed head.

The game is played in a simple maze where your task is to go round and gobble up asterisks while avoiding Horace. When he catches you he eats you. All the mazes have traps, and they also have exits: when you take an exit the screen clears and you appear in another maze. As in Pacman you sometimes get the chance to eat items of fruit. You turn into a hideous ghost-like face and can eat Horace, just for a change.

The board is large in area but not in complexity, being based on a 10-by-six grid. You get a different view of Horace according to the direction he is heading. If he is going sideways, you get a sideways view; if he's going towards the bottom of the screen you see him full-face; if he's going up the screen you see the back of his head.

The sounds are a little better than average for Spectrum software, though that is not saying a great deal. The main problem with Horace is learning the keys. The game uses I for up and A for down, and the I and P keys for left and right. It is not a particularly satisfactory choice.

The best thing about Hungry Horace is that the action is fast, which makes it challenging. Though patently ridiculous, Hungry Horace is fun to play.

Specification

Type: arcade-type game with colour and sound
Format: cassette tape
System: 16K or 48K Spectrum
Manufacturer: Psion with Melbourne House for Sinclair
Price: £5.95
Rating: 14/20

Penetrator

THE BLURB for Penetrator describes it as "the fastest and most exciting game for your 48K Spectrum". Not having played all of them I cannot guarantee the truth of this claim but it is certainly one of the most challenging, and few games for any microcomputer offer as many user facilities.

Penetrator is a Scramble-type game where you must fly your fighter through a complicated series of landscapes and caverns while either shooting, bombing or dodging the numerous rockets that are trying to destroy you. The eventual aim is to survive all four defence rings and to blow up an illegal cache of neutron bombs.

The game requires a great deal of practice to play well, but fortunately — and, I believe, uniquely — Penetrator is equipped with extremely good learning facilities. For a start it will quite happily play a demonstration game, and there is no better way of finding out what a game is all about.

If you press T you move into a training mode. Here you are allowed an unlimited supply of fighters, which you will certainly need to master each stage separately without continually restarting the game. Finally Penetrator can be customised to your own skill level.

The game allows you to redesign the moving horizontal landscape to make it easier to fly through. You can also reduce or increase the number of missiles and radar bases. In stage 4 you can reduce the number of enemy paratroopers, which look like black masks.

You must also give some thought to flying backwards through the landscape if you wish to be able to escape after blowing up the neutron bombs. Redesigning the landscape does take considerable time and effort, but it is possible to save the result on tape for reuse.

It must be admitted that Pentrator is not easy to play without a joystick. Control of the fighter is by using the Q and A keys for up and down and the P and O keys for forward thrust and braking relative to the scrolling landscape. P also acts as a fire button: you use short presses to fire and long ones for thrust. This may sound difficult but in practice it works well.

To drop bombs you just hit any key on the bottom row, which is a good way of getting round the Spectrum's lack of a proper space bar. Again it shows thoughtful game design.

The action in Penetrator is not all that fast and furious, but it takes place in a limited area with your fighter constantly under attack, so it does require quick reactions. The movement of the fighter itself is smooth, considering the method of controlling it. Missiles move slowly but quantity makes up here for the limited graphics.

The instructions on the cassette label are excellent and include good advice about playing the game. Re-reading the instructions can actually improve your scores!

Even if you do not much like Scramble as a game, Penetrator is quite playable. Even if you do not have a Spectrum to play it on, the concept of game design and user friendliness within the limitations of the Spectrum make a worthwhile instruction course. Congratulations to the author, Philip Mitchell. More games for all machines should be written this way.

Specification

Type: arcade game with colour graphics and sound
Format: cassette tape
System: 48K Spectrum
Manufacturer: Melbourne House, 131 Trafalgar Road, London SE10
Price: £6.95
Rating: 15/20

Programming for disabled users

Robin Nixon puts in a plea for software that can be tailored to individual users' needs. Only when it becomes available will the claim that micros "help the disabled" become justified.

RECENTLY THERE HAS been a marked growth in the number of microcomputers being used by the disabled. Although the technology has been available, it was never fully used until prices came within the reach of individuals.

Now that the market is flooded with micros, there are new problems. The first is that of input devices. Due to the nature of handicap, there is no hardware that can be mass-produced cheaply. Each individual needs individually tailored equipment. It is not so much of a problem until you start writing the software, and discover all the possibilities of input that your program has to take into account.

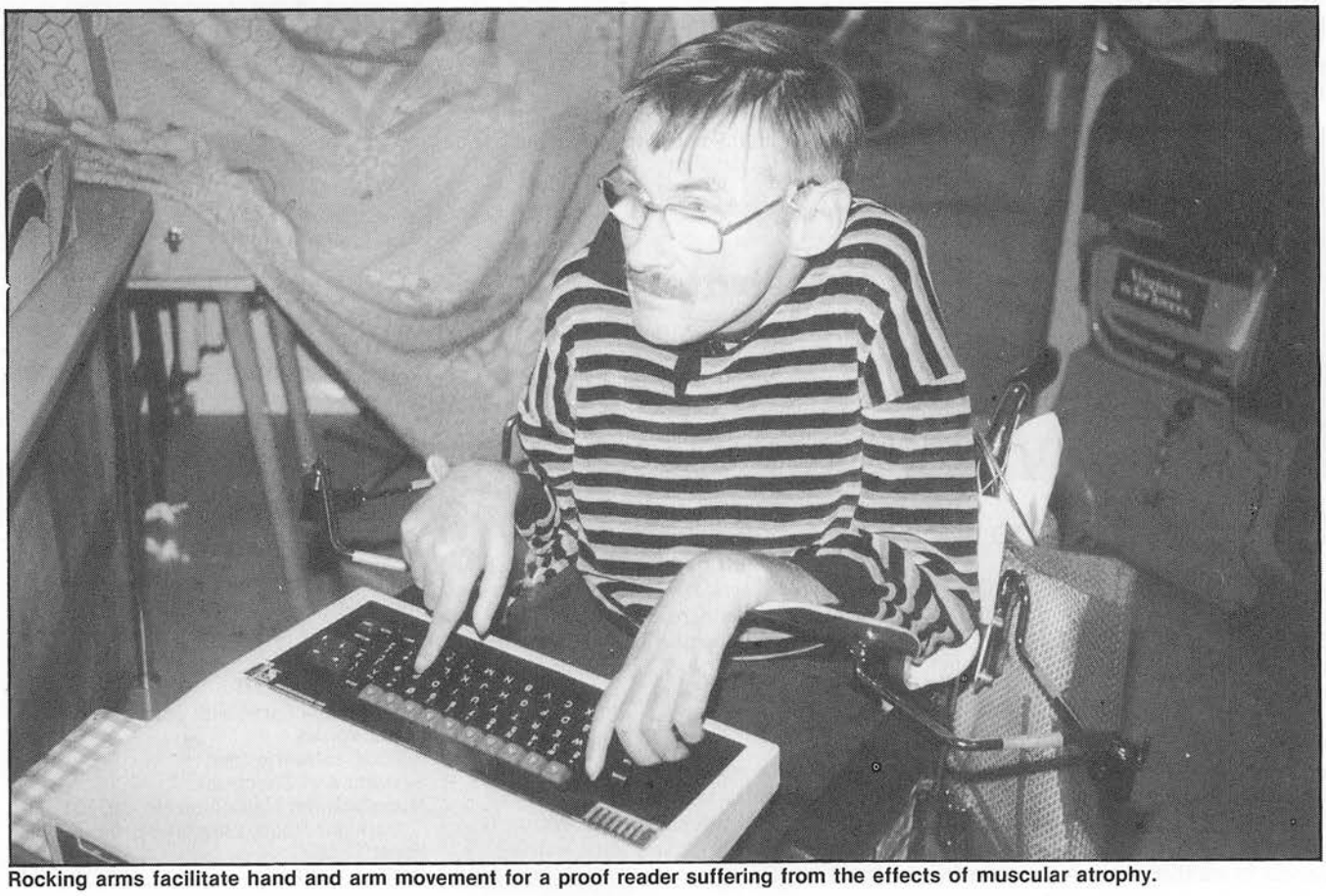
The second problem is output. Many disabled people have impaired vision, so a TV screen will not always be the best of choices. Speech synthesis is improving by leaps and bounds, but is still difficult to use — especially for a blind person. And what about people who are both deaf and blind? Because all these problems must be tackled individually, there is a distinct lack of software written specifically for the disabled.

Robin Nixon is the computer librarian at the Seven Springs Cheshire Home, Tunbridge Wells.

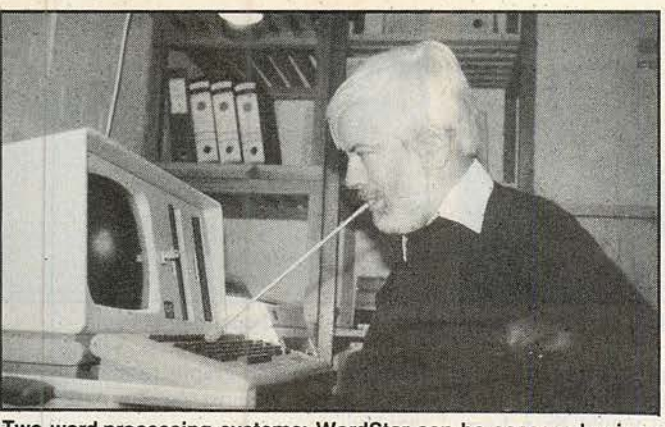
Writing programs for the disabled can be very challenging and also very rewarding. When you see someone who has never been able to write a letter or play any games without the help of another person using your software, and thus becoming more independent, you know you have created something worthwhile. Although an outline of how to write for the disabled is helpful there is no real replacement for actually visiting a home or school and getting to know the people involved. This includes the staff, as they have a better idea than anyone, except the resident concerned, of the abilities of each person. They are the people who will tell you exactly what is needed and give you some good ideas about how to get going.

The most commonly used input devices are based around a scanning system, normally using either one or two switches. Using one switch, a cursor can be made to scan horizontally along an alphanumeric matrix — see figure 1. To type the letter y the first switch would be pressed and held down until the cursor had scanned along to bak — see figure 2. Upon releasing the switch the cursor scans down. When the chosen letter is highlighted by the cursor the switch is pressed again, and the letter is entered into the computer — see figure 3.

The two-switch mode is similar, except



Rocking arms facilitate hand and arm movement for a proof reader suffering from the effects of muscular atrophy.



Two word-processing systems: WordStar can be accessed using a mouthstick, and MacApple, a pedal-operated system.

the first switch is used for the horizontal scan and the second for the vertical. The first switch, when pressed a second time, enters the letter. The matrix can be replaced at any time by a punctuation board, a number board, or a word or phrase board.

It may seem a rather slow way of going about it, but many handicapped operators have such limited use of their limbs that a system like this is the best until speech-recognition technology reaches a very high standard. Of course many people will be able to use more than two switches: the speed of entry increases with each switch.

The methods of input are virtually limitless: a lot of thought needs to be put into the selection and development of an input for each individual user. Apart from the two most common outputs, video and printer, there are very few others that are easy to use. Speech synthesis is perhaps the most widely used of the alternatives. Its standard of voice reproduction is intelligible, and will become better as a great deal of work is being done in this field. Eventually the hardware will become cheaper and more simple to use.

Many disabled users have some kind of eye tremor or other deficiency of vision. So, if a visual display is chosen, it must be exceptionally clear and as large as possible. One way of making video output clearer is to use two screens. The first could contain the letter matrix and any other relevant information, such as the last word or sentence typed in. The size of the letters displayed could then be as large as the user required leaving, hopefully, plenty of room on the main screen for running the program.

The output you find the best may be very

Robin Nixon's Krypton game.

```
100  HOME
110 P = 0:Y = 3:W = 6:F = 50
120 FG = 1
130 SP = 4
140  GOSUB 1020
150  HOME
160  IF  PEEK (0 - 16287) > 127 THEN 160
170  FOR X = 0 TO 9:A(X) = X: NEXT
180  FOR X = 1 TO 20:B =  INT ( RND (1) * 10):C =  INT ( RND (B) * 10)
190 D = A(B):A(B) = A(C):A(C) = D: NEXT
200  VTAB 1: HTAB 16: INVERSE : PRINT "KRYPTON": NORMAL : PRINT
210  VTAB 4: PRINT "  PRESS GREEN WHEN THE ROOM NUMBER YOU
     WANT IS LIT                    OR PRESS RED FOR A NEW GAME       ---
     ----------------------------------"
220 B( INT ( RND (1) * 10)) = 1
230  FOR X = 1 TO 4
240 C =  INT ( RND (1) * 10): IF B(C) > 0 THEN 240
250 B(C) = 3
260  IF X = 3 THEN B(C) = B(C) - 1
270  NEXT
280  FOR X = 1 TO 3
290 C =  INT ( RND (1) * 10): IF B(C) > 0 THEN 290
300 B(C) = 4
310  NEXT
320 X = 0
330 R =  INT ( RND (1) * 10)
340  VTAB 9: HTAB 1: PRINT "YOU ARE IN ROOM NUMBER ";: INVERSE : PRINT A(R
     );: NORMAL
350 SC = SC + 1
360  VTAB 12: HTAB 1
370  ON B(R) + 1 GOTO 480,380,410,410,500
380  PRINT "YOU HAVE FOUND THE POWER CRYSTALS FOR   THE TELEPORTER.

                                ";:P = 1
390  PRINT "
                              "
400  GOTO 550
410  PRINT "YOU ARE IN A TELEPORTER
                            ";
420  PRINT "

                                ";
430  PRINT "

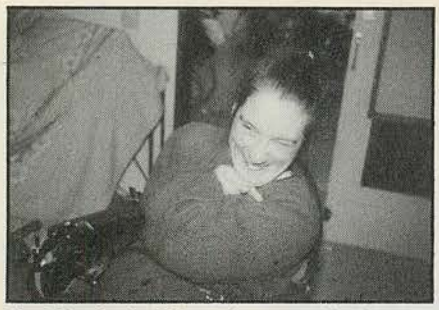
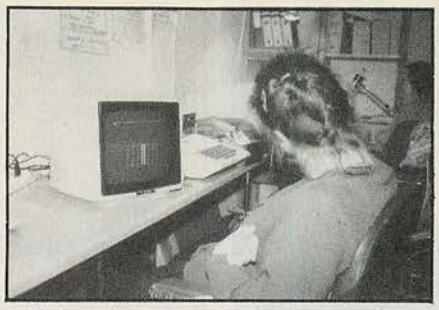
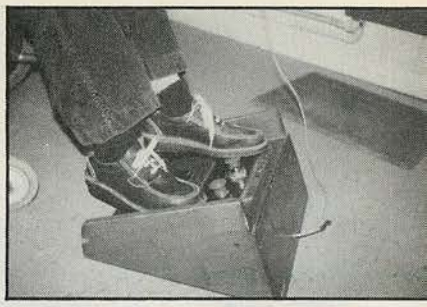
                                ";: FOR J = 1 TO 1500: NEXT
440  VTAB 14: HTAB 1
450  IF P = 0 THEN  PRINT "YOU DO NOT HAVE THE POWER CRYSTALS. THISMACHINE
      IS THEREFORE ";: INVERSE : PRINT "OUT OF ACTION": NORMAL : GOTO 550
460  GOSUB 800
470  GOTO 550
480  PRINT "

                                ";
490  PRINT "
                            ";: GOTO 550
500  PRINT "YOU HAVE BEEN EXPOSED TO KRYPTONITE.";K = K + 1: IF K = 5 THEN
     970
510  PRINT "ANOTHER ";: INVERSE : PRINT 5 - K;: NORMAL : PRINT " TIMES AND
      YOU WILL ";: INVERSE : PRINT "DIE";: NORMAL
520  PRINT "

                                              ";
530  PRINT : PRINT
540  HTAB 1: VTAB 22: INVERSE : PRINT "KRYPTONITE EXPOSURE";: NORMAL : PRINT
     " = ";K;
550  VTAB 18: HTAB 1: PRINT "YOU CAN GO TO ROOMS  ";
560 G = R - 1: IF G < 0 THEN G = 9
570 H = R + 1: IF H > 9 THEN H = 0
580  INVERSE : PRINT A(G);: NORMAL : PRINT " AND ";: INVERSE : PRINT A(H);
     : NORMAL
590  GOSUB 650
600  IF X <  > A(G) AND X <  > A(H) THEN  FOR Z = 1 TO 1000: NEXT : GOTO 5
     90
610  IF A(G) = X THEN R = G: GOTO 630
620 R = H
630  FOR S1 = 1 TO 100:S =  PEEK ( - 16336): NEXT
640  GOTO 340
650  VTAB 24: HTAB (6): PRINT "0  1  2  3  4  5  6  7  8  9";
660 FL = 0
670  INVERSE : GOSUB 780
680 S =  - 16336
690 S =  PEEK (S) -  PEEK (S) +  PEEK (S) -  PEEK (S) +  PEEK (S) -  PEEK
     (S)
700  FOR Z = 1 TO F
710  IF  PEEK (0 - 16287) > 127 THEN 770
720  IF  PEEK (1 - 16287) > 127 THEN FL = 1
730  NEXT : NORMAL : GOSUB 780:X = X + 1: IF X > 9 THEN X = 0
740  IF FL AND FG THEN  RETURN
750  IF FL THEN  RUN
760  GOTO 670
770  NORMAL : GOSUB 780: RETURN
780  VTAB 24: HTAB X + Y + W
790  PRINT X;: RETURN
800  VTAB 12: HTAB 1: PRINT "

                                                ";
810  INVERSE : VTAB 12: HTAB 1: PRINT "PRESS RED TO TELEPORT": NORMAL
820  IF  PEEK (1 - 16287) < 128 THEN 820
830  IF  PEEK (1 - 16287) > 127 THEN 830
840  VTAB 14: HTAB 1
850  IF B(R) <  > 2 THEN  PRINT "SORRY THIS TELEPORTER DOESN'T WORK
     NOT EVEN WITH POWER CRYSTALS)": RETURN
860  FLASH
870  PRINT "CONGRATULATIONS!!  YOU HAVE SUCCESSFULLYCOMPLETED YOUR MISSION
     !!!!!!"
880  NORMAL
890  PRINT : PRINT "YOUR SCORE = ";SC + K
900  FOR X = 1 TO 300:S =  PEEK ( - 16336): NEXT
910  FOR X = 1 TO 50:S =  PEEK ( - 16336): NEXT
920  FOR X = 1 TO 300:S =  PEEK ( - 16336): NEXT
930  VTAB 24: HTAB 6: FLASH : PRINT ")) PRESS RED TO PLAY AGAIN ((";
940  IF  PEEK (1 - 16287) > 127 THEN 940
950  IF  PEEK (1 - 16287) < 128 THEN 950
960  NORMAL : RUN
970  VTAB 9: HTAB 1: PRINT "


                                ";
980  PRINT "
                                                ";
990  FOR X = 1 TO 200:S =  PEEK ( - 16336): NEXT : FOR X = 1 TO 200:ZZ = Z
     Z + 1:S =  PEEK ( - 16336): NEXT : FOR X = 1 TO 200:ZZ = ZZ + 1:ZZ =
     ZZ + 1:S =  PEEK ( - 16336): NEXT
1000  FOR X = 1 TO 50:ZZ = ZZ + 1:ZZ = ZZ + 1:ZZ = ZZ + 1:ZZ = ZZ + 1:ZZ =
     ZZ + 1:S =  PEEK ( - 16336): NEXT
1010  FLASH : VTAB 9: HTAB 12: PRINT "YOU'RE DEAD!!!!": NORMAL :K = SC + K
     : GOTO 890
1020  VTAB 1: HTAB 1: PRINT "PRESS RED IF THIS IS THE SPEED YOU WANT."
1030  PRINT : PRINT "    TO CHANGE THE SPEED PRESS GREEN."
1040  PRINT : PRINT : PRINT "                ";
1050  PRINT "0=FASTEST  9=SLOWEST"
1060  VTAB 12: HTAB 15: PRINT "SPEED = ";SP: GOSUB 650
1070  IF FL THEN FG = 0: RETURN
1080 F = (X + 1) * 10
1090 SP = X
1100  GOTO 1060
```

The MacApple WP and communications system is based on an Apple II with twin discs, controlled by a foot-operated console.

Disabled users

(continued from previous page)

surprising. I know one young man who has extremely poor vision and almost no hearing. He uses a hand-held buzzer, from which he feels pulses of morse code which the computer translates from any text stored in memory. He is a keen football supporter and likes to follow the scores. Instead of spelling them out to him on his hand in finger language, it is easy to type them into a computer and leave him to go over them in his own time.

Whatever the program you are writing, it is essential to bear in mind that most users will be very inexperienced in the use of computers. A Help menu must be accessible at all times. Also the program needs to be interesting and not too complicated. A comprehensive manual would be a boon since many disabled users have to rely on unskilled assistance.

Games programs can be very useful in an environment where there is naturally a large amount of free time. The most popular games are Scrabble, Monopoly, Othello, Chess and Draughts. Action games such as Space Invaders and Pacman would be especially welcome if a simple method of input were chosen and the speed of play made variable to allow for those with slower reflexes.

Although there are many communication programs around, they are mostly based on the same scanning system. A possibile alternative is to develop a language based on thoughts and symbols, each of which would be entered into the computer, and the combination translated into English.

Good programs for drawing anything from pictures and graphs to mathematica functions are in short supply. A prograr that I have not as yet come across is a routir to allow the user to enter and run Bas programs — not as easy as it sounds.

I have deliberately not been explicit in th description of the software that is no available. There is a good chance that, if le to your own imagination, you will come u with a totally new concept in the design c programs for the disabled. But if you d need help write to the author at Seve Springs Cheshire Home, Pembury Roac Tunbridge Wells, Kent TN2 4NB wher there is a national program library for th disabled. We would like to see you programs shared by as many people a possible.

a.	[sp]	E	bak	S	H	ret
b.	sp	[E]	bak	S	H	ret
c.	sp	E	[bak]	S	H	ret

Figure 2. Scanning horizontally.

sp	E	bak	S	H	ret	
T	A	I	L	B	W	
O	N	D	M	G	,	
R	C	Y	F	J	.	
U	P	V	X	Z	*	
+ −	K	Q	uc	;:	?	

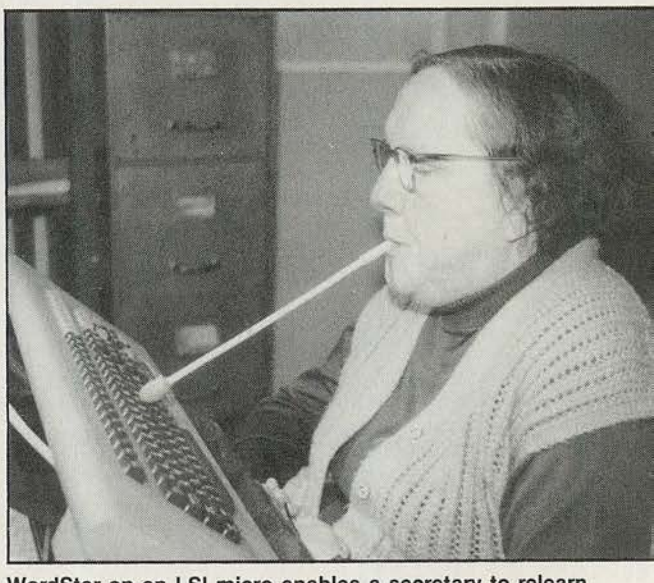
sp, space; bak,backspace; ret, return; uc, upper case

Figure 1. Possible display for a scanning system.

[bak]	bak	bak	bak
I	[I]	I	I
D	D	[D]	D
Y	Y	Y	[Y]
V	V	V	V
Q	Q	Q	Q
a.	b.	c.	d.

Figure 3. Scanning vertically.

An alternative mouthstick controller allows MacApple to be used by operators without the need to exercise fine control of the limbs.



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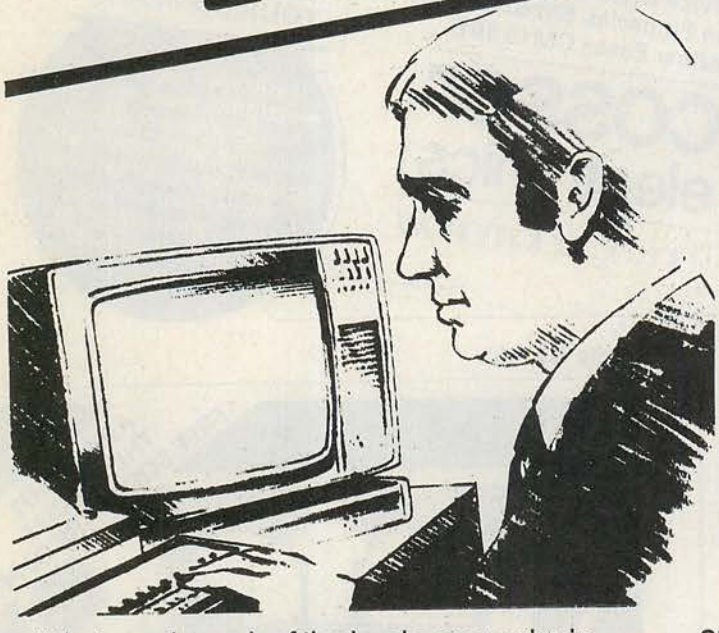

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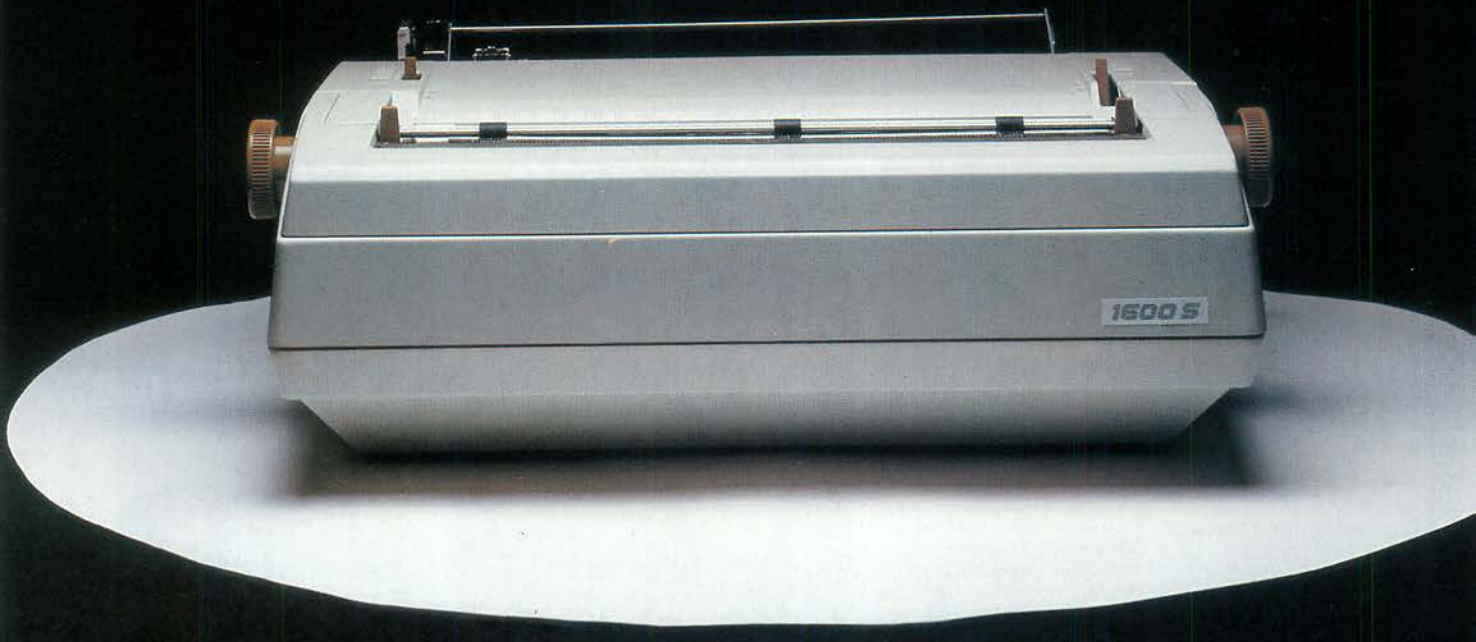

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Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, Sinclair Line-up and other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Contributors receive £30 per published page and pro rata for part pages, with a minimum of £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

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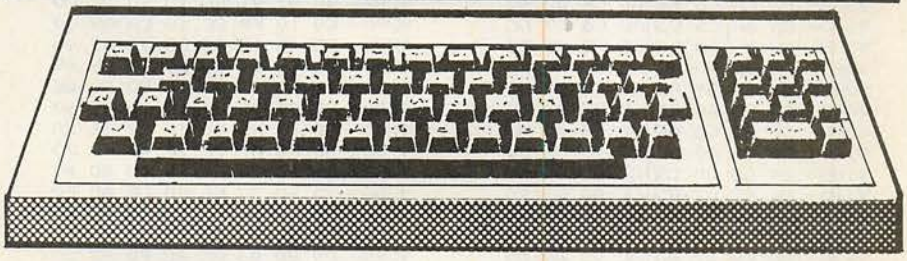
End of File: Handling dates, in MBasic; Print At on the Sharp MZ-80K — the first of our regular sections on portable or general-purpose routines **165**



Guidelines for contributors

Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

APPLE PIE

by John Harris

Menu catalogue

N OBJECT CODE PROGRAM to exhibit the art address and length of binary program les on disc together with details of other les in the catalogue comes from J J Taylor

(continued on next page)

Menu catalogue.

```
]LOAD HELLO
]LIST 300,310

300  HOME : VTAB 10: PRINT " CATA
     LOG BY J.TAYLOR"
301  PRINT
305  PRINT "                14 WOODWA
     Y CLOSE,"
306  PRINT
307  PRINT "                TEIGNMOUT
     H, DEVON."
308  VTAB 20: PRINT "CALL 36864 O
     R $9000G TO RETURN TO MENU"
309  FOR I = 1 TO 5000: NEXT I
310  PRINT "BRUN MENU CATALOG"
```

Menu catalogue. Hex dump.

```
]BLOAD MENU CATALOG,A$9000
]CALL -151

*9000.9512

9000- 4C 17 91 A9 90 A0 0B 20
9008- D9 03 60 01 60 01 00 11
9010- 0F 1C 90 00 60 00 00 01
9018- 00 00 60 01 00 01 EF D8
9020- AA BD BD BD BD BD BD BD
9028- BD BD BD BD A0 CD C5 CE
9030- D5 A0 C3 C1 D4 C1 CC CF
9038- C7 A0 BD BD BD BD BD BD
9040- BD BD BD BD BD AA 8D AA
9048- D7 C9 CC CC A0 D2 D5 CE
9050- A0 C2 D2 D5 CE A0 CF D2
9058- A0 C5 D8 C5 C3 A0 C1 D3
9060- A0 C1 D0 D0 D2 CF D0 D2
9068- C9 C1 D4 C5 AA 8D AA BD
9070- BD D4 D9 D0 C5 BD BD C6
9078- C9 CC C5 CE C1 CD C5 BD
9080- BD BD BD BD BD BD BD A0
9088- C2 D3 D4 C1 D2 D4 A0 C2
9090- CC C5 CE AA 00 CB C5 D9
9098- A0 CE CF AE A0 CF C6 A0
90A0- D4 C8 C5 A0 D0 D2 CF C7
90A8- D2 C1 CD A0 D4 CF A0 D2
90B0- D5 CE BA AD 00 8D 84 D2
90B8- D5 CE A0 00 C2 C9 CE C1
90C0- D2 D9 AF C1 D0 D0 CC C5
90C8- D3 CF C6 D4 A0 CF D2 A0
90D0- C5 D8 C5 C3 A0 C6 C9 CC
90D8- C5 D3 A0 D0 CC C5 C1 D3
90E0- C5 8D A0 A0 A0 A0 A0 A0
90E8- C1 CE D9 A0 CB C5 D9 A0
90F0- D4 CF A0 C3 CF CE D4 C9
90F8- CE D5 C5 AE A0 A0 A0 A0
9100- A0 A0 A0 A0 A0 A0 00 8D
9108- 84 C5 D8 C5 C3 A0 00 8D
9110- 84 C2 D2 D5 CE A0 00 20
9118- 58 FC A9 00 85 73 A9 90
9120- 85 74 AD EA B7 8D 0D 90
9128- AD E9 B7 8D 0C 90 A9 02
9130- 85 F9 85 22 20 5B FB A0
9138- 00 84 08 B9 20 90 F0 07
9140- 20 ED FD C8 4C 3B 91 A9
9148- 05 85 22 A9 16 20 5B FB
9150- A9 60 85 1E A9 01 85 1F
9158- 20 8E FD 4C 6E 91 A5 1E
9160- 69 01 85 1E 8D 14 90 A5
9168- 1F 69 01 85 1F 18 20 03
9170- 90 A9 0E 85 1A A5 1E 85
9178- 1B A0 00 B1 1A C9 00 F0
9180- 3A A5 1A E9 03 85 1C A5
9188- 1E 85 1D B1 1C C9 FF F0
9190- 2D A5 1F 85 44 20 66 94
9198- A9 04 85 24 A0 00 B1 1A
91A0- 20 4A FF 20 BC 93 20 C7
91A8- 93 20 3F FF A0 00 B1 1A
91B0- 20 ED FD C0 14 F0 13 C8
91B8- 4C AE 91 4C 67 92 C6 1F
91C0- 4C 6D 92 A9 00 85 08 4C
91C8- 6A 92 A5 08 F0 F5 A5 1A
91D0- 48 A5 1B 48 AD 10 90 48
91D8- AD 0F 90 48 AD 13 90 48
91E0- AD 14 90 48 38 A5 1A 48
91E8- E9 03 85 1A A0 00 B1 1A
91F0- 8D 0F 90 68 85 1A 38 A5
91F8- 1A E9 02 85 1A B1 1A 8D
9200- 10 90 A9 00 8D 13 90 A9
9208- 80 8D 14 90 20 03 90 AD
9210- 0C 80 8D 0F 90 AD 0D 80
9218- 8D 10 90 A9 80 8D 14 90
9220- A9 00 8D 13 90 20 03 90
9228- AD 01 80 20 DA FD AD 00
9230- 80 20 DA FD A9 A0 20 ED
9238- FD A9 A0 20 ED FD AD 03
9240- 80 20 DA FD AD 02 80 20
9248- DA FD A9 00 85 08 68 8D
9250- 14 90 68 8D 13 90 68 8D
9258- 0F 90 68 8D 10 90 68 85
9260- 1B 68 85 1A 4C 6A 92 4C
9268- 9E 92 20 8E FD 18 A5 1A
9270- 69 23 85 1A 90 03 4C 8B
9278- 92 A5 1F 69 01 85 1F 18
9280- A0 00 B1 1A C9 00 F0 16
9288- 4C 81 91 CE 10 90 2C 00
9290- C0 10 FB 2C 10 C0 A9 00
9298- 85 48 18 4C 5E 91 A9 00
92A0- 85 48 A9 00 20 48 F9 A9
92A8- 00 85 22 8D 19 90 20 8E
92B0- FD A9 0F 8D 10 90 A9 60
92B8- 8D 14 90 C6 1F A9 16 20
92C0- 5B FB A2 26 20 4A F9 20
92C8- 8E FD 20 8E FD A0 00 B9
92D0- 95 90 20 ED FD C9 AD F0
92D8- 08 C8 4C CF 92 CA 4C E5
92E0- 92 A2 00 A0 00 20 35 FD
92E8- C9 8D D0 03 4C FD 92 20
92F0- ED FD 9D 11 95 C9 88 F0
92F8- E4 E8 4C E5 92 8A C9 02
9300- F0 11 A2 00 BD 11 95 A2
9308- 01 9D 11 95 A9 B0 A2 00
9310- 9D 11 95 20 92 94 18 A9
9318- 60 85 1B A9 01 85 ED A9
9320- 0B 85 1A A0 00 B1 1A C9
9328- FF D0 18 C6 ED 18 A5 1A
9330- 69 23 85 1A 90 07 E6 1B
9338- E6 ED 4C 1F 93 E6 ED 18
9340- 4C 23 93 A5 ED C5 EB F0
9348- 03 4C 2D 93 A5 1A 69 01
9350- 85 1A 90 02 E6 1B 18 A0
9358- 00 B1 1A C9 00 F0 17 C9
9360- 80 F0 13 C9 04 F0 20 C9
9368- 84 F0 1C C9 82 F0 29 C9
9370- 02 F0 25 4C D6 94 20 58
9378- FC A0 00 B9 07 91 F0 29
9380- 20 ED FD C8 4C 7B 93 20
9388- 58 FC A0 00 B9 0F 91 F0
9390- 18 20 ED FD C8 4C 8C 93
9398- 20 58 FC A0 00 B9 B5 90
93A0- F0 07 20 ED FD C8 4C 9D
93A8- 93 A0 01 B1 1A F0 07 20
93B0- ED FD C8 4C AB 93 20 8E
93B8- FD 4C D0 03 A5 1A E9 01
93C0- 85 1C A5 1E 85 1D 60 B1
93C8- 1C C9 82 D0 0F A9 AA 20
93D0- ED FD A9 C1 20 ED FD A9
93D8- A0 20 ED FD C9 02 D0 0F
93E0- A9 A0 20 ED FD A9 C1 20
93E8- ED FD A9 A0 20 ED FD C9
93F0- 84 D0 11 E6 08 A9 AA 20
93F8- ED FD A9 C2 20 ED FD A9
9400- A0 20 ED FD C9 04 D0 11
9408- E6 08 A9 A0 20 ED FD A9
9410- C2 20 ED FD A9 A0 20 ED
9418- FD C9 01 D0 0F A9 A0 20
9420- ED FD A9 C9 20 ED FD A9
9428- A0 20 ED FD C9 81 D0 0F
9430- A9 AA 20 ED FD A9 C9 20
9438- ED FD A9 A0 20 ED FD C9
9440- 80 D0 0F A9 AA 20 ED FD
9448- A9 D4 20 ED FD A9 A0 20
9450- ED FD C9 00 D0 0F A9 A0
9458- 20 ED FD A9 D4 20 ED FD
9460- A9 A0 20 ED FD 60 A0 02
9468- A9 00 48 A5 44 D9 A4 B3
9470- 90 12 F9 A4 B3 85 44 A5
9478- 45 E9 00 85 45 68 69 00
9480- 48 4C 6B 94 68 09 B0 C0
9488- 02 F0 03 20 ED FD 88 10
9490- D7 60 08 48 A9 00 85 EB
9498- A2 00 BD 11 95 E4 F9 F0
94A0- 12 E8 29 0F 20 B6 94 18
94A8- 65 EB 85 EB 90 EC E6 EC
94B0- 4C 9A 94 68 28 60 08 48
94B8- 06 EB 26 EC A5 EC 48 A5
94C0- EB 06 EB 26 EC 06 EB 26
94C8- EC 18 65 EB 85 EB 68 65
94D0- EC 85 EC 68 28 60 A9 00
94D8- 85 08 85 24 A9 16 20 5B
94E0- FB A0 00 B9 BC 90 F0 07
94E8- 20 ED FD C8 4C E3 94 2C
94F0- 00 C0 10 FB 2C 10 C0 A0
94F8- 00 A9 00 85 24 A9 16 20
9500- 5B FB 20 42 FC A9 00 85
9508- 24 A9 16 20 5B FB 4C CF
9510- 92 FF B3
```

(continued from previous page)

of Teignmouth, Devon. After listing, the program allows any of the files to be Run, BRun or Execed as appropriate, using a numeric selection return. Mr Taylor normally ends programs with a return to menu option, Call 36864.

Frightening though the condensed hex listing is, the full source listing takes rather a lot of space. Mr Taylor will send you a disassembled listing or, if you prefer, disc copy on receipt of a disc — SSDD 40 track. His address is included in the Hello program extension printed.

DOS writer

With computer literacy growing as it is there are now two kinds of programmer: those who work in a commercial programming environment and those who don't. It is clear to which group Andrew Cox of Brigg, South Humberside belongs. He has sent a code generator capable of placing DOS commands into a Basic program.

Andrew Cox says the program was written to allow people to include short disc-access routines in their programs without having to learn the Apple DOS. The routines it can write cover a great deal of the everyday problems of storing variables and arrays on disc, and retrieving them. The program should be suited to people in a computer club, for example, who do not have the time to keep writing such routines. The programs produced will also show how DOS is used, maybe to people taking the O-level computer course where DOS is not covered by the syllabus.

No commercial programming manager that I have ever met is going to allow a product like that on his site, and not many commercial programmers would want him to, whether it generates Basic, Cobol or what you will. It limits his flexibility of design, puts a further barrier between him and his machine and tends to make him more a program user than a program creator.

But for the rest of us, why not? It has the advantage of fewer keystrokes to a given result, and leaves the monotonous part of the code to take care of itself and highlights the problem needing solution.

What we have printed here is the listing itself, together with a sample run from which the menu-selection has been suppressed to save space.

Example program 1 sets up variable and array values, and calls the generated subroutine to store them on disc. Example program 2 retrieves these values — with the curious exception of ZZ = 1 — and displays them for verification.

The disc contents are catalogued to the printer at the end of program 1. An Exec file created from within the same program is

(continued on page 144)

DOS writer.

```
]LOAD DOS WRITER
]LIST

10 F1 = 0
20  TEXT : HOME : PRINT  TAB( 15)
    ;"DOS WRITER": PRINT : PRINT
    : PRINT "PLEASE WAIT A MOMEN
    T"
30 OP$ = "APPEND TEXT FILE":WR$ =
    "WRITE TEXT FILE":CL$ = "CLO
    SE TEXT FILE":D$ =  CHR$ (4)

40  DIM A$(255),A(9,1)
50  PRINT D$;"OPEN TEXT FILE"
60  PRINT D$;"DELETE TEXT FILE"
70  PRINT D$;"OPEN TEXT FILE": PRINT
    D$;"WRITE TEXT FILE": PRINT
    "MON C,I,O": PRINT D$;CL$
80  GOSUB 100
90  GOTO 310
100  REM   MAIN SUBROUTINE
110  HOME : VTAB 2: HTAB 15: PRINT
    "MAIN MENU"
120  HTAB 15: FOR Y = 1 TO 9: PRINT
    "-": NEXT : PRINT
130  VTAB 6
140  HTAB 15: PRINT "1. CATALOG"
150  PRINT
160  HTAB 15: PRINT "2. EXEC FILE
     WRITER"
170  PRINT
180  HTAB 15: PRINT "3. STORE VAR
    IABLES"
190  PRINT
200  HTAB 15: PRINT "4. STORE ARR
    AY"
210  PRINT
220  HTAB 15: PRINT "5. RETRIEVE
    VARIABLES"
230  PRINT
240  HTAB 15: PRINT "6. RETRIEVE
    ARRAY"
250  PRINT
260  HTAB 15: PRINT "7. QUIT"
270  PRINT
280  PRINT : HTAB 20: INPUT "ENTE
    R ITEM NO. ";A$
290 I% =  VAL (A$): IF I% < 1 OR
    I% > 7 THEN  VTAB  PEEK (37)
     - 2: GOTO 280
300  RETURN
310  IF F1 = 1 THEN 360
320  HOME : INPUT "NAME OF PROGRA
    M :-";NA$
330  PRINT : INPUT "STARTING FROM
     WHICH LINE :-";L
340 F1 = 1
350  PRINT D$;OP$: PRINT D$;WR$: PRINT

    "LOAD ";NA$: PRINT D$;CL$
360  ON I% GOTO 370,420,870,600,1
    020,680,1050
370  HOME : INPUT "WHICH DISC DRI
    VE (1 OR 2) ";D
380  IF D <  > 1 AND D <  > 2 THEN
    370
390  PRINT D$;OP$: PRINT D$;WR$
400  PRINT L;"PRINT CHR$(4);"; CHR$
    (34);"CATALOG,D";D; CHR$ (34
    ):L = L + 10
410  PRINT D$;CL$: GOTO 1240
420  HOME : INPUT "ENTER NAME OF
    EXEC FILE YOU WISH TO      CR
    EATE :-";NB$
430  IF  LEN (NB$) < 1 THEN 420
440  INPUT "DO YOU WISH TO EXECUT
    E IT AT THE END?   (Y/N)";A$

450  IF  LEFT$ (A$,1) <  > "Y" THEN
    A$ = "N"
460  HOME : PRINT "INPUT COMMANDS
    , TO STOP TYPE 'RETURN'  ALO
    NE"
470  FOR I = 0 TO 255: GOSUB 1150
    :A$(I) = A$: IF A$ = "" THEN
    490
480  NEXT :I = I - 1
490 A = I - 1
500  PRINT D$;OP$: PRINT D$;WR$
510  PRINT L;"REM FILE ";NB$:L =
    L + 10
520  PRINT L;" PRINT CHR$(4);" CHR$
    (34);"OPEN ";NB$; CHR$ (34):
    L = L + 10
530  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"DELETE ";NB$; CHR$ (34
    ):L = L + 10
540  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"OPEN ";NB$; CHR$ (34):
    L = L + 10
550  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"WRITE ";NB$; CHR$ (34)
    :L = L + 10
560  FOR I = 0 TO A: PRINT L;" PR
    INT "; CHR$ (34);A$(I); CHR$
    (34):L = L + 10: NEXT
570  IF A$ = "Y" THEN  PRINT L;"P
    RINTCHR$(4);"; CHR$ (34);"EX
    EC ";NB$; CHR$ (34):L = L +
    10
580  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"CLOSE ";NB$; CHR$ (34)
    :L = L + 10
590  PRINT D$;CL$: GOTO 1240
600  GOSUB 670
610  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"DELETE ARRAY ";NB$; CHR$
    (34):L = L + 10
620  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"OPEN ARRAY ";NB$; CHR$
    (34):L = L + 10
630  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"WRITE ARRAY ";NB$; CHR$
    (34):L = L + 10
640  FOR I = 1 TO A: PRINT L;"FOR
     I";I;"="A(I,0);" TO ";A(I,1
    ):L = L + 10: NEXT
650  PRINT L;"PRINT"NB$;"(";: FOR
    I = 1 TO A: PRINT "I";I;",";
    : NEXT : PRINT  CHR$ (8);")"
    :L = L + 10
660  GOTO 830
670  REM  SUBROUTINE
680  HOME : INPUT "ENTER THE NAME
     OF THE ARRAY :-";NB$
690  IF  LEN (NB$) < 1 THEN 680
700  INPUT "HOW MANY DIMENSIONS ?
    ";A
710  IF A > 9 THEN  HOME : PRINT
    "ARRAY TOO COMPLEX, SIMPLIFY
    ": GOTO 700
720  FOR I = 1 TO A
730  HOME : PRINT "ENTER THE EXTE
    NT OF THE DIMENSION"
740  PRINT "IN THE FORM 'FROM','T
    O'": INPUT A(I,0),A(I,1): IF
    A(I,1) < A(I,0) THEN  PRINT
    "THEFIRST DIMENSI ON MUSTBES
    MALLERTHANTHESEC ON D": FOR
    J = 1 TO 5000: NEXT : GOTO 7
    30
750  NEXT
760  PRINT D$;OP$: PRINT D$;WR$
770  PRINT L;"REM ARRAY "NB$:L =
    L + 10
780  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"OPEN ARRAY ";NB$; CHR$
    (34):L = L + 10
790  IF I% = 4 THEN  RETURN
800  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"READ ARRAY ";NB$; CHR$
    (34):L = L + 10
810  FOR I = 1 TO A: PRINT L;"FOR
     I";I;"=";A(I,0);" TO ";A(I,
    1):L = L + 10: NEXT
820  PRINT L;"INPUT";NB$;"(";: FOR
    I = 1 TO A: PRINT "I";I;",";
    : NEXT : PRINT  CHR$ (8);")"
    :L = L + 10
830  FOR I = 1 TO A: PRINT L;"NEX
    T":L = L + 10: NEXT
840  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"CLOSE ARRAY ";NB$; CHR$
    (34):L = L + 10
850  PRINT D$;CL$
860  GOTO 1240
870  HOME : INPUT "NAME OF FILE :
    -";NB$
880  IF  LEN (NB$) < 1 THEN 870
890  FOR I = 1 TO 255: HOME : PRINT
    "ENTER NAME OF VARIABLE ";I:
     PRINT "'RETURN' ALONE TO FI
    NISH :-";
900  INPUT "";A$(I): IF A$(I) = "
    " THEN  GOTO 920
910  NEXT :I = I - 1
920 A = I - 1
930  PRINT D$;OP$: PRINT D$;WR$
940  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"OPEN ";NB$; CHR$ (34):
    L = L + 10: IF I% = 5 THEN RETURN

950  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"DELETE ";NB$; CHR$ (34
    ):L = L + 10
960  IF I% = 5 THEN  RETURN
970  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"OPEN ";NB$; CHR$ (34):
    L = L + 10
980  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"WRITE ";NB$; CHR$ (34)
    :L = L + 10
990  FOR I = 1 TO A: PRINT L;"PRI
    NT ";A$(I):L = L + 10: NEXT

1000  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"CLOSE ";NB$; CHR$ (34)
    :L = L + 10
1010  PRINT D$;CL$: GOTO 1240
1020  GOSUB 870
1030  PRINT L;"PRINTCHR$(4);"; CHR$
    (34);"READ ";NB$; CHR$ (34):
    L = L + 10
1040  FOR I = 1 TO A: PRINT L;"IN
    PUT ";A$(I):L = L + 10: NEXT
    : GOTO 1000
1050  HOME : PRINT "PLEASE WAIT A
     MOMENT---"
1060  PRINT D$;OP$: PRINT D$;WR$
1070  PRINT "RENAME ";NA$;",ORIGI
    NAL ";NA$
1080  PRINT "SAVE ";NA$
1090  PRINT "HOME:LIST"
1100  PRINT "NOMON C,I,O"
1110  PRINT "DELETE TEXT FILE"
1120  PRINT D$;CL$
1130  PRINT D$;"EXEC TEXT FILE"
1140  NEW
1150 A$ = ""
1160 X =  POS (0):Y =  PEEK (37)
1170  IF X > 40 THEN X = 1:Y = Y +
    1
1180  GET X$
1190  IF X$ =  CHR$ (13) THEN  PRINT
    : RETURN
1200  IF X$ =  CHR$ (34) AND F2 =
    0 THEN A$ = A$ +  CHR$ (34) +
    ";CHR$(34);" +  CHR$ (34):F2
     = 1: GOTO 1230
1210  IF X$ =  CHR$ (34) AND F2 =
    1 THEN A$ = A$ +  CHR$ (34) +
    ";CHR$(34);":F2 = 0: GOTO 12
    30
1220 A$ = A$ + X$
1230  POKE 36,X: POKE 37,Y: PRINT
    X$;: GOTO 1160
1240  HOME : INPUT "SUBROUTINE (Y
    /N)?";A$: IF  LEFT$ (A$,1) <
     > "Y" THEN 80
1250  PRINT D$;OP$: PRINT D$;WR$
1260  PRINT L;"RETURN":L = L + 10

1270  PRINT D$;CL$: GOTO 80


]CATALOG

DISK VOLUME 001

 A 007 HELLO
 B 007 MENU CATALOG
 A 002 PRINTSET
 A 010 FARLIE
 T 003 TEXT FILE
 A 017 DOS WRITER
 A 002 EXAMPLE 2
 A 006 EXAMPLE

]LOAD DOS WRITER
]100 GO TO 280:REM MENU SUPPRESS

]RUN
              DOS WRITER


PLEASE WAIT A MOMENT

                    ENTER ITEM NO. 1
NAME OF PROGRAM :-EXAMPLE

STARTING FROM WHICH LINE :-1000
WHICH DISC DRIVE (1 OR 2) 1
SUBROUTINE (Y/N)?N

                    ENTER ITEM NO. 2
ENTER NAME OF EXEC FILE YOU WISH TO
 CREATE :-EXAMPLE EXEC
DO YOU WISH TO EXECUTE IT AT THE END?
 (Y/N)Y
INPUT COMMANDS, TO STOP TYPE 'RETURN'
ALONE
CATALOG

SUBROUTINE (Y/N)?N

                    ENTER ITEM NO. 3
NAME OF FILE :-VARIABLES
ENTER NAME OF VARIABLE 1
'RETURN' ALONE TO FINISH :-A
ENTER NAME OF VARIABLE 2
'RETURN' ALONE TO FINISH :-Z
ENTER NAME OF VARIABLE 3
'RETURN' ALONE TO FINISH :-A$
ENTER NAME OF VARIABLE 4
'RETURN' ALONE TO FINISH :-Z$
ENTER NAME OF VARIABLE 5
'RETURN' ALONE TO FINISH :-N%
ENTER NAME OF VARIABLE 6
'RETURN' ALONE TO FINISH :-A
ENTER NAME OF VARIABLE 7
'RETURN' ALONE TO FINISH :-
SUBROUTINE (Y/N)?N
```

(listing continued on next page)

(listing continued from previous page)

```
                    ENTER ITEM NO. 4
ENTER THE NAME OF THE ARRAY :-A%
HOW MANY DIMENSIONS ?2
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,5
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,4
SUBROUTINE (Y/N)?N

                    ENTER ITEM NO. 4
ENTER THE NAME OF THE ARRAY :-B
HOW MANY DIMENSIONS ?2
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,3
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,2
SUBROUTINE (Y/N)?N

                    ENTER ITEM NO. 4
ENTER THE NAME OF THE ARRAY :-C$
HOW MANY DIMENSIONS ?1
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,26
SUBROUTINE (Y/N)?Y

                    ENTER ITEM NO. 7
PLEASE WAIT A MOMENT---



JLOAD ORIGINAL EXAMPLE
JLIST

10  REM THIS TESTS OPTIONS 1-4
20 A = 1:Z = 26:A$ = "HELLO":Z$ =
     "GOODBYE":N% = 14:VA = 12.34

30  DIM A%(5,4),B(3,2),C$(26)
40  FOR I = 1 TO 5: FOR J = 1 TO
     4:A%(I,J) = 5 * I + J: NEXT
     : NEXT
50  FOR I = 1 TO 3: FOR J = 1 TO
     2:B(I,J) = 1.1 * I + J: NEXT
     : NEXT
60  FOR I = 1 TO 26:C$(I) =  STR$
     (I): NEXT
70  GOSUB 1000
80  END


JLOAD EXAMPLE
JLIST

10  REM THIS TESTS OPTIONS 1-4
20 A = 1:Z = 26:A$ = "HELLO":Z$ =
     "GOODBYE":N% = 14:VA = 12.34

30  DIM A%(5,4),B(3,2),C$(26)
40  FOR I = 1 TO 5: FOR J = 1 TO
     4:A%(I,J) = 5 * I + J: NEXT
     : NEXT
50  FOR I = 1 TO 3: FOR J = 1 TO
     2:B(I,J) = 1.1 * I + J: NEXT
     : NEXT
60  FOR I = 1 TO 26:C$(I) =  STR$
     (I): NEXT
70  GOSUB 1000
80  END
1000  PRINT  CHR$ (4);"CATALOG,D1
     "
1010  REM  FILE EXAMPLE EXEC
1020  PRINT  CHR$ (4);"OPEN EXAMP
     LE EXEC"
1030  PRINT  CHR$ (4);"DELETE EXA
     MPLE EXEC"
1040  PRINT  CHR$ (4);"OPEN EXAMP
     LE EXEC"
1050  PRINT  CHR$ (4);"WRITE EXAM
     PLE EXEC"
1060  PRINT "CATALOG"
1070  PRINT  CHR$ (4);"CLOSE EXAM
     PLE EXEC"
1080  PRINT  CHR$ (4);"OPEN VARIA
     BLES"
1090  PRINT  CHR$ (4);"DELETE VAR
     IABLES"
1100  PRINT  CHR$ (4);"OPEN VARIA
     BLES"
1110  PRINT  CHR$ (4);"WRITE VARI
     ABLES"
1120  PRINT A
1130  PRINT Z
1140  PRINT A$
1150  PRINT Z$
1160  PRINT N%
1170  PRINT A
1180  PRINT  CHR$ (4);"CLOSE VARI
     ABLES"
1190  REM  ARRAY A%
1200  PRINT  CHR$ (4);"OPEN ARRAY
     A%"
1210  PRINT  CHR$ (4);"DELETE ARR
     AY A%"
1220  PRINT  CHR$ (4);"OPEN ARRAY
     A%"
1230  PRINT  CHR$ (4);"WRITE ARRA
     Y A%"
1240  FOR I1 = 1 TO 5
1250  FOR I2 = 1 TO 4
1260  PRINT A%(I1,I2)
1270  NEXT
1280  NEXT
1290  PRINT  CHR$ (4);"CLOSE ARRA
     Y A%"
1300  REM  ARRAY B
1310  PRINT  CHR$ (4);"OPEN ARRAY
     B"
1320  PRINT  CHR$ (4);"DELETE ARR
     AY B"
1330  PRINT  CHR$ (4);"OPEN ARRAY
     B"
1340  PRINT  CHR$ (4);"WRITE ARRA
     Y B"
1350  FOR I1 = 1 TO 3
1360  FOR I2 = 1 TO 2
1370  PRINT B(I1,I2)
1380  NEXT
1390  NEXT
1400  PRINT  CHR$ (4);"CLOSE ARRA
     Y B"
1410  REM  ARRAY C$
1420  PRINT  CHR$ (4);"OPEN ARRAY
     C$"
1430  PRINT  CHR$ (4);"DELETE ARR
     AY C$"
1440  PRINT  CHR$ (4);"OPEN ARRAY
     C$"
1450  PRINT  CHR$ (4);"WRITE ARRA
     Y C$"
1460  FOR I1 = 1 TO 26
1470  PRINT C$(I1)
1480  NEXT
1490  PRINT  CHR$ (4);"CLOSE ARRA
     Y C$"
1500  RETURN


JLOAD DOS WRITER
J100 GO TO 280:REM MENU SUPPRESS

JRUN
                DOS WRITER


PLEASE WAIT A MOMENT

                    ENTER ITEM NO. 5
NAME OF PROGRAM :-EXAMPLE 2

STARTING FROM WHICH LINE :-1000
NAME OF FILE :-VARIABLES
ENTER NAME OF VARIABLE 1
'RETURN' ALONE TO FINISH :-X
ENTER NAME OF VARIABLE 2
'RETURN' ALONE TO FINISH :-Y
ENTER NAME OF VARIABLE 3
'RETURN' ALONE TO FINISH :-X$
ENTER NAME OF VARIABLE 4
'RETURN' ALONE TO FINISH :-Y$
ENTER NAME OF VARIABLE 5
'RETURN' ALONE TO FINISH :-Z%
ENTER NAME OF VARIABLE 6
'RETURN' ALONE TO FINISH :-ZZ
ENTER NAME OF VARIABLE 7
'RETURN' ALONE TO FINISH :-
SUBROUTINE (Y/N)?N

                    ENTER ITEM NO. 6
ENTER THE NAME OF THE ARRAY :-X%
HOW MANY DIMENSIONS ?2
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,5
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,4
SUBROUTINE (Y/N)?N

                    ENTER ITEM NO. 6
ENTER THE NAME OF THE ARRAY :-Y
HOW MANY DIMENSIONS ?2
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,3
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,2
SUBROUTINE (Y/N)?N

                    ENTER ITEM NO. 6
ENTER THE NAME OF THE ARRAY :-Z$
HOW MANY DIMENSIONS ?1
ENTER THE EXTENT OF THE DIMENSION
IN THE FORM 'FROM','TO'
?1,26
SUBROUTINE (Y/N)?Y
                    ENTER ITEM NO. 7
PLEASE WAIT A MOMENT---



JLOAD ORIGINAL EXAMPLE 2
JLIST

10  REM THIS TESTS OPTIONS 5-6
20 X = 0:Y = 0:X$ = "":Y$ = "":Z%
     = 0:ZZ = 0
30  DIM X%(5,4),Y(3,2),Z$(26)
40  GOSUB 1000
50  PRINT "1=";X: PRINT "26=";Y: PRINT
     "HELLO=";X$: PRINT "GOODBYE=
     ";Y$: PRINT "14=";Z%: PRINT
     "12.34=";ZZ
60  PRINT "23=";X%(4,3): PRINT "3
     .2=";Y(2,1): PRINT "20=";Z$(
     20)
70  END


JLOAD EXAMPLE 2
JLIST

10  REM THIS TESTS OPTIONS 5-6
20 X = 0:Y = 0:X$ = "":Y$ = "":Z%
     = 0:ZZ = 0
30  DIM X%(5,4),Y(3,2),Z$(26)
40  GOSUB 1000
50  PRINT "1=";X: PRINT "26=";Y: PRINT
     "HELLO=";X$: PRINT "GOODBYE=
     ";Y$: PRINT "14=";Z%: PRINT
     "12.34=";ZZ
60  PRINT "23=";X%(4,3): PRINT "3
     .2=";Y(2,1): PRINT "20=";Z$(
     20)
70  END
1000  PRINT  CHR$ (4);"OPEN VARIA
     BLES"
1010  PRINT  CHR$ (4);"READ VARIA
     BLES"
1020  INPUT X
1030  INPUT Y
1040  INPUT X$
1050  INPUT Y$
1060  INPUT Z%
1070  INPUT ZZ
1080  PRINT  CHR$ (4);"CLOSE VARI
     ABLES"
1090  REM  ARRAY X%
1100  PRINT  CHR$ (4);"OPEN ARRAY
     X%"
1110  PRINT  CHR$ (4);"READ ARRAY
     X%"
1120  FOR I1 = 1 TO 5
1130  FOR I2 = 1 TO 4
1140  INPUT X%(I1,I2)
1150  NEXT
1160  NEXT
1170  PRINT  CHR$ (4);"CLOSE ARRA
     Y X%"
1180  REM  ARRAY Y
1190  PRINT  CHR$ (4);"OPEN ARRAY
     Y"
1200  PRINT  CHR$ (4);"READ ARRAY
     Y"
1210  FOR I1 = 1 TO 3
1220  FOR I2 = 1 TO 2
1230  INPUT Y(I1,I2)
1240  NEXT
1250  NEXT
1260  PRINT  CHR$ (4);"CLOSE ARRA
     Y Y"
1270  REM  ARRAY Z$
1280  PRINT  CHR$ (4);"OPEN ARRAY
     Z$"
1290  PRINT  CHR$ (4);"READ ARRAY
     Z$"
1300  FOR I1 = 1 TO 26
1310  INPUT Z$(I1)
1320  NEXT
1330  PRINT  CHR$ (4);"CLOSE ARRA
     Y Z$"
1340  RETURN



JLOAD EXAMPLE
JRUN
```

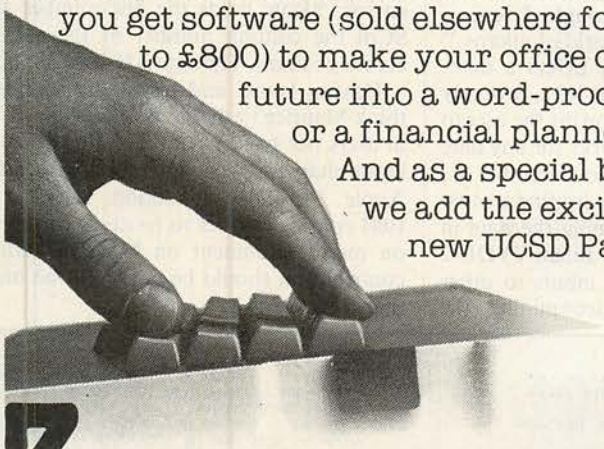
(continued on page 144)

DOUBLE DENSITY OSBORNE AND PRAXIS

£1599 + VAT

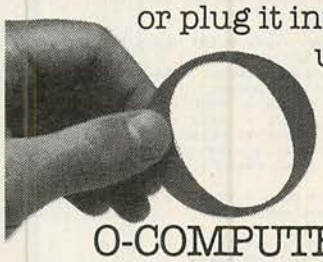
THE OFFICE OF THE FUTURE TODAY

1 The heart of this office of the future is the powerful new "double density" Osborne 1 portable computer with 64k memory, two 200k disc drives and built-in monitor. The Osborne is linked to an Olivetti Praxis 30 11cps daisy-wheel printer/typewriter for printing your work superbly. In addition you get software (sold elsewhere for up to £800) to make your office of the future into a word-processor or a financial planner. And as a special bonus we add the exciting new UCSD Pascal.



2 Your Osborne and Praxis are a remarkable combination. The machines are so portable you can carry them both home instead of working late. Plug them together slip the Wordstar/Mailmerge disc into the drive and you have a word-processor with twice the capacity of earlier Osbornes. Change discs for Supercalc and you have the power of a dozen clerks for your budgets. Then Osborne types your work perfectly on Praxis.

3 The Olivetti Praxis 30 is a new style electronic typewriter with its own memory, automatic erase, and a double keyboard which gives you 14 extra characters. Use your Praxis on its own as a prestige easy-to-use typewriter, or plug it into your Osborne and use it as a high quality computer printer.



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104-106 Rochester Row, London SW1
Telephone: 01-828 9000

● Circle No. 191

(listing continued from page 142)

```
DISK VOLUME 001

 A 007 HELLO
 B 007 MENU CATALOG
 A 002 PRINTSET
 A 010 FARLIE
 A 017 DOS WRITER
 A 006 EXAMPLE
 A 005 EXAMPLE 2
 A 002 ORIGINAL EXAMPLE 2
 A 006 ORIGINAL EXAMPLE

]RENAME ARRAY A%,ARRAY X%
]RENAME ARRAY B,ARRAY Y
]RENAME ARRAY C$,ARRAY Z$
]RUN EXAMPLE 2
1=1
26=26
HELLO=HELLO
GOODBYE=GOODBYE
14=14
12.34=1
23=23
3.2=3.2
20=20

]EXEC EXAMPLE EXEC
]

DISK VOLUME 001

 A 007 HELLO
 B 007 MENU CATALOG
 A 002 PRINTSET
 A 010 FARLIE
 T 002 EXAMPLE EXEC
 A 017 DOS WRITER
 A 006 EXAMPLE
 A 005 EXAMPLE 2
 T 002 VARIABLES
 T 002 ARRAY X%
 A 002 ORIGINAL EXAMPLE 2
 T 002 ARRAY Y
 T 002 ARRAY Z$
 A 006 ORIGINAL EXAMPLE
```

(continued from page 140)

used after the end of program 2 to show the store files.

The fact that this utility does not tie in with commercial practice saddens me, but that will not stop me from using it. The average commercial computer department is hampered more by its existing user software than by any other single liability, and redesigning with the inclusion of high-level generators like this would clear a lot of dead wood.

Date validation

Maurice Farlie of Balham, south London writes criticising Robin Kanagasabay's Apple Stock suite published last August: "I fully laud Robin Kanagasabay's intention to 'ensure that the program is easy to use and to make the operating environment friendly. Unfortunately, I think he has failed lamentably in some areas.

"The program displays an almost total lack of data for creating or modifying stock records, a potentially disasterous omission in any system. Garbage data, duplicate data in fields which are used subsequently for searching, a record length exceeding 60 bytes and reports corrupted by fields which are too long are all practical possibilities.

"Nor is the program particularly 'friendly' when it does reject input as invalid. There is a price to pay in any program. This one needs over 11K of memory already but I suggest proper input validation is a necessary cost in any program with serious pretentions. I ought to admit my own extensive background in data processing, including some years as a systems designer and more recently in programmer training, though I am a relative newcomer to the world of micros."

Mr Farlie coincidentally offers a date-validation routine which, he says, properly validates the user input, allowing the user to omit leading zeros, and works for any date between January 1, 1901 and December 31, 1999. Output from the main routine are two fixed-length strings containing the date in Gregorian DDMMYY and Julian YYDDD forms. They can serve as inputs to other date routines such as determining the number of days between two dates or generating the date in the form:

THURSDAY 20TH AUGUST 1982

Numeric variables containing day, month and two-digit year numbers are also available.

Occasionally, the wrong date or an incorrect character is keyed in. Line 29600 automatically rejects invalid characters.

Users can backspace over one or more characters — lines 29582 to 29588 — and can also reject the date input and start again — lines 29660 to 29680. For the purpose of displaying messages and repositioning the cursor, SRow holds the line number and SCol the column number of the current cursor position. The date is built up in Inp$.

Having keyed and tested the routine I think Maurice Farlie shows a touching faith in users not backspacing beyond their first input character. I hereby declare open the Apple Pie Date-Validation Routine of 1983 contest, winner to be declared strictly on merit. Comment on Maurice Farlie's contribution should be limited to no more than 250 words.

Date validation.

```
]LOAD FARLIE
]LIST

29400  REM ***** DATE SUB *****
29410  REM  MTH BEGINNINGS & DAYS
       IN MTH FOR NON-LEAP YR
29420  DATA   001,032,060,091,121
       ,152,182,213,244,274,305,335

29430  DATA   31,28,31,30,31,30,3
       1,31,30,31,30,31
29440  DIM MTHBGN(12),DYSMTH(12)
29450  FOR I = 1 TO 12: READ MTHB
       GN(I): NEXT I
29460  FOR I = 1 TO 12: READ DYSM
       TH(I): NEXT I
29480  RETURN
29490  REM ***** END DATE SUB ***
       **
29495  REM
29500  REM *****GET DATE SUB*****

29520  PRINT : INVERSE : PRINT "E
       NTER NEW DATE (DD/MM/YY) THE
       N 'RETURN'": NORMAL
29530  LET SROW =  PEEK (37) + 1
29540  LET SCOL = 3: HTAB SCOL: CALL
       - 868
29545  LET CCNT = 0
29550  LET INP$ = "/": REM  TO EN
       ABLE B/S TO 1ST CHAR ENTERED

29560  FOR CNT = 1 TO 9: REM  +(C
       R)
29570  GET CH$
29580  IF CH$ <  > CHR$ (8) THEN
       GOTO 29590
29582  LET SCOL = SCOL - 1: HTAB
       SCOL: CALL  - 868
29584  LET CCNT = CCNT - 1: LET C
       NT = CNT - 1
29586  LET INP$ =  LEFT$ (INP$,( LEN
       (INP$) - 1))
29588  GOTO 29570
29590  IF CH$ =  CHR$ (13) AND CN
       T > 5 THEN  LET INP$ = INP$ +
       "/": GOTO 29660
29600  IF  ASC (CH$) < 47 OR  ASC
       (CH$) > 57 THEN  GOTO 29610
29602  PRINT CH$;
29605  IF CH$ = "/" THEN  LET CCN
       T = 0: GOTO 29620
29607  IF CCNT < 2 THEN CCNT = CC
       NT + 1: GOTO 29640
29610  LET MSG$ = "ILLEGAL CHAR":
       GOSUB 30000: GOTO 29570
29620  IF  RIGHT$ (INP$,1) = "/" THEN
       LET MSG$ = "INVALID SEQUENC
       E": GOSUB 30000: GOTO 29570
29640  LET SCOL = SCOL + 1
29645  LET INP$ = INP$ + CH$
29650  NEXT CNT
29660  HTAB ( LEN (INP$) + 5): LET
       MSG$ = "OK": GOSUB 30100
29670  IF REPLY$ = "N" THEN  VTAB
       SROW: GOTO 29540
29700  REM  STORE IN GDTE$ DDMMYY

29705  LET GDTE$ = ""
29710  LET CCNT = 0
29715  LET INP$ =  RIGHT$ (INP$,(
       LEN (INP$) - 1)): REM  STRI
       P OFF LEADING '/'
29720  FOR I = 1 TO  LEN (INP$)
29730  IF  MID$ (INP$,I,1) <  > "
       /" THEN CCNT = CCNT + 1: GOTO
       29770
29740  IF CCNT = 1 THEN  LET GDTE
       $ = GDTE$ + "0" +  MID$ (INP
       $,I - 1,1): GOTO 29760
29750  LET GDTE$ = GDTE$ +  MID$
       (INP$,I - 2,2)
29760  LET CCNT = 0
29770  NEXT
29780  LET DD =  VAL ( LEFT$ (GDT
       E$,2))
29790  LET MM =  VAL ( MID$ (GDTE
       $,3,2))
29800  LET YY =  VAL ( RIGHT$ (GD
       TE$,2))
29835  LET LYR = (YY / 4 =  INT (
       YY / 4))
29840  LET SCOL =  LEN (INP$) + 2

29845  VTAB SROW: HTAB SCOL: CALL
       - 868
29850  IF MM <  = 0 OR MM > 12 THEN
       LET MSG$ = "MTH INVALID": GOSUB
       30000: GOTO 29540
29870  IF DD <  = 0 OR DD > DYSMT
       H(MM) + (LYR AND MM = 2) THEN
       LET MSG$ = "DAY INVALID": GOSUB
       30000: GOTO 29540
29880  IF YY = 0 THEN  LET MSG$ =
       "ZERO YR NOT ALLOWED": GOSUB
       30000: GOTO 29540
29900  REM  **CONVERT DATE TO JUL
       IAN FORMAT
29905  LET JDTE$ =  STR$ (YY * 10
       00 + MTHBGN(MM) + DD + (LYR AND
       MM > 2) - 1)
29910  IF  LEN (JDTE$) = 4 THEN J
       DTE$ = "0" + JDTE$
29980  RETURN
29990  REM  ***** END GET DATE SU
       B *****
30000  REM  ***** GET INPUT ERROR
       SUB *****
30010  VTAB SROW: HTAB SCOL + 2
30015  FLASH : PRINT MSG$; CHR$ (
       7)
30020  FOR I = 1 TO 1500: NEXT I
30030  NORMAL : VTAB SROW: HTAB S
       COL: CALL  - 868
30040  RETURN
30045  REM  *****END GET INPUT ER
       ROR SUB *****
30048  REM
30100  REM  ***** PRINT MSG & GET
       Y/N SUB *****
30110  INVERSE : PRINT MSG$ + "?
       (Y/N) ";: NORMAL
30130  LET SROW =  PEEK (37) + 1
30140  LET SCOL =  PEEK (36) + 1
30150  GET REPLY$: PRINT REPLY$;
30160  IF REPLY$ = "Y" OR REPLY$ =
       "N" THEN  PRINT : GOTO 30190

30170  LET MSG$ = "Y/N ONLY": GOSUB
       30000: GOTO 30150
30190  RETURN
30195  REM  ***** END PRINT MSG &
       GET Y/N SUB *****
30198  REM
```

C/WP BITES £200 OFF APPLE II E

Meet the Apple II E, the brand new much improved version of the tried and trusty Apple II. The "E" has (almost) everything you ever wished the Apple had. The memory has been increased to 64k with an optional expansion to 128k. The keyboard has sprouted extra keys, making 63 in all, with proper shift keys and four arrow keys to drive the cursor round the screen. The screen boasts capitals and lower case letters (40 to a line—or 80 with a low cost optional add-on). And for brilliant colour the "E" has a built-in PAL encoder—just add a modulator and it plugs straight into your colour television set.

The 80 column card is only £70 (no, it won't work with the Apple II Europlus). For £150, you can buy another card which provides both 80 columns and an extra 64k of memory which switches in and out as required.

Apple II has joined the big league.

But there's one thing Apple Computer has not changed. The "E" still runs all (or almost all) Apple II's enormous library of software without reprogramming or adaptation. Alas, the "E" costs more than its predecessor. But C/WP has had its way and is cutting £200 off the recommended retail price. The "E" is yours for a modest £645 plus VAT.

Or if you prefer it, we can still sell you an old-fashioned Apple II Europlus at the old-fashioned price—£499 plus VAT.

Prices do not include VAT.	RRP	C/WP Price
Apple II E	£845	£645
80 column card	£80	£70
80 column card + 64k	£180	£150
Monitor and stand	£170	£130
Disc drive with controller	£345	£270
Disc drive without controller	£245	£220
C/WP Contour 3 Mb	—	£995
6 Mb	—	£1195
12 Mb	—	£1495
21 Mb	—	£1995
Multiplan	£185	£175

C/WP

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● Circle No. 192

SINCLAIR LINE-UP

Press any key

THIS SHORT MACHINE-CODE ROUTINE by P Horton of Havant, Hampshire waits until you press a key then returns the code of the key you pressed.

The machine code is stored in a Rem statement 23 characters long and is used by the line:

LET A$ = CHR$ (USR 16514)

A$ will contain the key pressed.

To enter the machine code type in the Basic loader program and run it. Then delete all the lines except line 10. The routine can also be used as a foolproof version of the old "press any key to continue" routine.

Music

THE ZX-81 music program by M Wiseman of Downham Market fits into 4K. The notes are generated by the machine code stored in line 1. The length of a note is stored by Poke 16516,n, where n is the length. The pitch is controlled by Poke 16518,n and the note is generated by USR 16514. Instructions for the program are contained in Print statements from line 1000.

Spectrum games

TWO SHORT GAMES and a machine-code routine for the Spectrum come from C D Henderson of Edinburgh. The first is a simple version of Asteroids; you use Z and X to control your ship as you move down the screen, scoring points. If you reach the bottom you return to the top with a bonus of 25 points.

A simple but fast version of the popul game Brick-Out uses keys 6 and 7 to mo you down and up. Both programs conta colour, sound and user-definable graphic so ZX-81 conversion would be difficult.

The machine-code routine is a fast sid scroll, unlike many others produce elsewhere:

```
10 Clear 32499
20 For a = 32500 to 32561: read b: Poke
   a,b
30 Next a
40 Data 33, 1, 64, 17, 0, 64, 1, 128, 21, 237,
   176, 201
```

It is called inside a For-Next loop by

RAND USR 32500

Asteroid dodge

A DODGE for the asteroids game comes fro Justin Rowling of Sudbury, Suffolk. Th scrolling is achieved in three steps:

```
POKE 22692, 255
PRINT AT 21, 31; " "
PRINT
```

The Poke disables the automatic scroll. Th Print At moves the next print position o the screen, and the print moves the displa up one: 1 moves left and 0 moves right.

Press any key.

```
.LOOP   CALL KSCAN      CD BB 02
        LD B,H          44
        LD C,L          4D
        INC L           2C
        JRZ .LOOP       28 F8
        CALL KFIND      CD BD 07
        LD C,(HL)       4E
        LD B,00         06 00
        PUSH BC         C5
.WAIT   CALL KSCAN      CD BB 02
        INC L           2C
        JRNZ .WAIT      20 FA
        POP BC          C1
        RET             C9
```

```
10 REM 123456789012345678901234
20 LET A$="CDBB02444D2C28F8CDBD0
74E0600C5CDBB022C20FAC1C9"
30 FOR A=16514 TO 16536
40 POKE A,CODE A$*16+CODE A$(2)-
476
50 LET A$=A$(3 TO )
60 NEXT A
70  STOP
```

Asteroid dodge.

```
 70 LET X=0: LET L=0: LET Y=3
 80 DEF FN b()=INT (RND*7)
 90 LET z=15
100 DEF FN a()=INT (RND*31)+1
105 PRINT AT Y,z;"V"
110 LET a=FN a()
120 LET B=FN B()
140 LET a$="**"
210 PRINT AT 21,a;a$
220 PRINT AT 21,B;a$
240 POKE 23692,255: PRINT AT 21
,31;" ": PRINT
250 PRINT AT Y-1,Z-1;"   "
260 IF SCREEN$ (Y,z)="*" THEN L
ET L=L+1
265 IF L=3 THEN GO SUB 2000
270 LET z=z+(INKEY$="0")-(INKEY
$="1")
275 BEEP .01,30
276 LET X=X+1
277 IF INKEY$=" " THEN LET Y=IN
T (RND*21)
280 GO TO 105
2000 PRINT AT Y,z-2; FLASH 1;"SP
LAT"
2010 FOR N=1 TO 6: BEEP .05,30:
BEEP .05,20: NEXT N
2020 PRINT AT 0,0;"SCORE ";X
2030 FOR N=1 TO 400: NEXT N
2035 PRINT AT 21,0;"PRESS ANY KE
Y TO RUN AGAIN"
2040 IF INKEY$="" THEN GO TO 204
0
2050 RUN
```

Music.

```
  1 REM "   2 "?■CO5 14 RAND +AC
S PI4■PEEK COPY /"(= RETURN / RE
M
  2 POKE 16520,120
  3 GOSUB 1000
 10 DIM Z$(2,512)
 20 LET N=1
 25 DIM A$(2)
 30 CLS
 31 PRINT "NOTE=";N
 40 GOTO 80
 50 PRINT "NOTE?"
 55 INPUT A
 60 LET N=A
 70 GOTO 30
 80 PRINT "TIME(0=END)=";CHR$ (
28+INT (CODE Z$(1,N)/16));CHR$ (
28+CODE Z$(1,N)-INT (CODE Z$(1,N
)/16)*16)
 90 INPUT A$
 95 IF A$="0 " THEN GOTO 200
100 IF A$="  " THEN GOTO 130
105 LET Q=CODE A$*16-448+CODE A
$(2)-28
106 IF Q<0 OR Q>255 THEN GOTO 5
0
110 LET Z$(1,N)=CHR$ (CODE A$(1
)*16-448+CODE A$(2)-28)
120 PRINT A$
130 PRINT "PITCH(0=REST)=";CHR$
(28+INT (CODE Z$(2,N)/16));CHR$
(28+CODE Z$(2,N)-INT (CODE Z$(2
,N)/16)*16)
140 INPUT A$
150 IF A$="  " THEN GOTO 180
155 LET Q=CODE A$*16-448+CODE A
$(2)-28
156 IF Q<0 OR Q>255 THEN GOTO 2
000
160 LET Z$(2,N)=CHR$ (CODE A$(1
)*16-448+CODE A$(2)-28)
180 LET N=N+1
190 GOTO 30
200 FOR A=1 TO 512
210 POKE 16516,CODE Z$(2,A)
211 REM 16=L,18=P
220 IF Z$(1,A)<>" " AND Z$(2,A)
=" " THEN GOTO 300
230 POKE 16516,CODE Z$(1,A)/1.5
240 IF Z$(1,A)=" " THEN GOTO 30
250 RAND USR 16514
260 NEXT A
270 GOTO 30
300 FOR B=1 TO CODE Z$(1,A)
310 NEXT B
320 GOTO 260
1000 PRINT "INSTRUCTIONS"
1010 PRINT ,,"ENTER THE LENGTH A
ND PITCH AS   2 HEX DIGITS (E.G.
 00,1A,FF)     TO CHANGE THE NOTE
```

(continued opposite)

(continued from opposite page)

```
 NO. TYPE A     LENGTH VALUE GREAT
ER THAN FF.     TO PLAY THE MUSIC
TYPE 00 FOR     THE LENGTH.
                TO SAVE THE MUSIC
TYPE A PITCH    VALUE GREATER THAN
 FF OR LESS     THAN 00.
                IF YOU DONT WANT T
O CHANGE A      VALUE JUST PRESS N
/L."
1020 PRINT "            PRESS N/L"
1030 PAUSE 32768
1040 RETURN
2000 PRINT "ENTER A NAME"
2010 INPUT B$
2020 IF B$="" THEN GOTO 30
2025 POKE 16390,255
2030 SAVE B$
2040 IF PEEK 16390<>255 THEN PRI
NT "FOUND ";B$
2050 PRINT ,,"PRESS N/L"
2055 POKE 16390,0
2060 PAUSE 32768
2970 GOTO 30
```

NOTE VALUES (C+ MEANS C SHARP)

C	FF	C+	F1	D	E3	D+	D6
E	CA	F	BF	F+	B4	G	AA
G+	A1	A	98	A+	8F	B	87
C	7F	C+	78	D	72	D+	6B
E	65	F	5D	F+	5A	G	55
G+	50	A	4C	A+	48	B	44
C	3B	C+	3C	D	39	D+	36
E	33	F	30	F+	2D	G	2B
G+	28	A	26	A+	24	B	22

Spectrum games.

```
   1 FOR a=0 TO 7: READ b: POKE
USR "a"+a,b: NEXT a
   2 DATA 0,BIN 00011000,BIN 001
11100,BIN 01111110,BIN 01111110,
BIN 00111100,BIN 00011000,0
   3 FOR a=0 TO 7: POKE USR "b"+
a,BIN 00000011: NEXT a
   4 GO TO 1000
   5 LET hs=0
  10 LET a=2: LET b=1: LET i=1:
LET d=1: LET e=1: LET f=7: LET s
=0: LET p=8: LET o=p
  50 BORDER 0: INK 7: PAPER 0
  60 PRINT "
                                "
  65 FOR y=1 TO 15: PRINT TAB 31
;"■": NEXT y
  67 PRINT "
                                "
  69 INK 5
  70 FOR y=1 TO 15: PRINT AT y,2
0;"#";AT y,21;"#";AT y,22;"#": N
EXT y
  72 INK 6
  75 FOR y=1 TO 15: PRINT AT y,2
7;"#";AT y,28;"#";AT y,29;"#": N
EXT y
  80 PRINT AT 19,3;"score   hi-s
core    ball"
  90 INK 7
  95 GO TO 200
 100 IF SCREEN$ (a,b)="#" THEN L
ET d=-d: BEEP .01,0: LET s=s+10:
 PRINT AT 20,5;s;AT 20,24;e;AT 2
0,15;hs
 102 PRINT AT a,b;"●": LET k=a:
LET j=b: LET a=a+c
 110 IF a>=15 OR a<=1 THEN LET c
=-c
 120 LET b=b+d
 130 IF b>=30 OR b=1 THEN LET d=
-d
 140 IF b=1 THEN GO TO 600
 150 PRINT AT k,j;" "
 160 IF INKEY$="6" AND p<13 THEN
 LET p=p+1: GO TO 200
 170 IF INKEY$="7" AND p>1 THEN
LET p=p-1: GO TO 200
 180 GO TO 100
 200 PRINT AT o,0;" ";AT o+1,0;"
";AT o+2,0;" "
 205 PRINT AT p,0;" ";AT p+1,0;"
";AT p+2,0;" "
 230 LET o=p
 300 GO TO 100
 600 IF p=a OR p+1=a OR p+2=a TH
EN GO TO 150
 603 PRINT AT k,j;" "
 605 IF s=900 THEN CLS : LET f=f
+1: GO TO 65
 607 LET a=INT (RND*3)+2
 610 LET e=e+1: IF e>=f THEN GO
TO 900
 650 PRINT AT 21,0;"press 'SPACE
' for next ball"
 660 IF INKEY$<>" " THEN GO TO 6
50
 670 PRINT AT 21,0;"
                    ": GO TO 100
 900 PRINT "GAME OVER YOUR SCORE
:";s: PRINT "hi-score";
 910 IF s>=hs THEN LET s=hs: PRI
NT hs: FOR x=1 TO 200: NEXT x: C
LS : GO TO 10
1000 BORDER 4: PAPER 3: INK 1: C
LS
1005 LET a$="BREAKOUT ©C.D.Hende
rson"
1007 PRINT '''';"    ";
1010 FOR a=1 TO LEN a$: PRINT a$
(a TO a);: PAUSE 5: NEXT a
1020 PRINT '''''  Move :UP    7
                       DOWN 6"
1025 PRINT '''''';"          ";
1030 PRINT FLASH 1;"PRESS ANY K
Y": FLASH 0: PAUSE 0
1040 BORDER 0: PAPER 0: INK 7: C
LS : GO TO 5

   1 CLS
  10 FOR n=144 TO 145
  11 FOR f=0 TO 7
  12 READ a: POKE USR CHR$ (n)+f
,a
  13 NEXT f
  14 NEXT n
  15 DATA 0,BIN 00011000,BIN 001
11100,BIN 01011010,BIN 00111100,
BIN 00011000,BIN 01100110,0
  16 DATA BIN 00001000,BIN 01101
100,BIN 00111110,BIN 01111100,BI
N 00111110,BIN 01110111,BIN 0110
0000,0
  17 GO SUB 300: LET x=2
  18 BORDER 0: BRIGHT 1: INK 7:
PAPER 0: CLS : BORDER 0: PAPER 0
  19 LET a=3: LET q=0: LET b=16:
 LET s=0
  20 PRINT AT a,b;"$"
  21 FOR c=1 TO 7
  22 PRINT AT INT (RND*4)+15,INT
 (RND*31);"▲"
  23 NEXT c
  24 FLASH 1: PRINT AT 0,0;"ASTE
ROID SHOWER": FLASH 0
  25 PAUSE 100
  29 POKE 23692,20
  30 PRINT AT 21,INT (RND*31);"▲
"
  31 PRINT AT 21,INT (RND*31);"▲
"
  32 LET a$=INKEY$: PRINT AT a,b
;" ": PRINT AT 21,0;'': IF CODE
SCREEN$ (a,b)=0 THEN GO TO 100
  33 IF a$="x" THEN LET b=b+x: I
F b>31 THEN LET b=30
  34 IF a$="z" THEN LET b=b-x: I
F b<0 THEN LET b=0
  35 LET q=q+.25: IF q/2=INT (q/
2) THEN LET a=a+1: IF a=20 THEN
GO SUB 1000
  36 PRINT AT a,b;"$";AT a-1,b;"
";AT a-2,b;" "
  37 LET s=s+1
  38 IF s>100 THEN LET x=1
  39 BEEP .01,20+(20-x)
  41 IF s/15=INT (s/15) THEN GO
TO 200
  42 GO TO 29
 100 CLS : PRINT s;" POInts": ST
OP
 200 PRINT AT 21,INT (RND*31);"▲
"
 205 GO TO 29
 300 FLASH 1: PRINT AT 10,10;" A
steroid Shower ": FLASH 0
 310 PRINT AT 20,5;"ANY KEY TO C
ONTINUE"
 311 PAUSE 0
 312 CLS : BORDER 7: INK 0: PAPE
R 5
 315 PRINT '''''    THE OBJECT OF
THIS GAME IS TOAVOID A NEVER END
ING  ASTEROID  SHOWER,YOU SCORE
POINTS FOR THISAND WHEN YOUR SHI
P REACHES THE  BOTTOM OF THE SCR
EEN YOU SCORE ABONUS & RETURN TO
 THE TOP"
 320 PRINT '''"You move using:"
 324 PRINT ''
 325 PRINT "          Z-▲-X"
 340 PRINT AT 20,5;"ANY KEY TO C
ONTINUE"
 350 PAUSE 0: CLS : RETURN
1000 LET s=s+25
1010 LET a=3: RETURN
```

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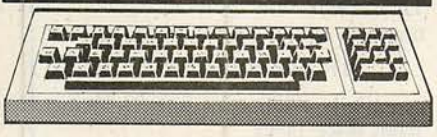

THE FIRST Atari Open File — January issue — did bring a response, albeit a small one. There is room for more so Atari users, send in your programs.

Load and List

The first program to arrive was on cassette in three versions, requring CLoad, Load "C:" and Enter "C:". The programs were originally saved using CSave, Save "C:" and List "C:" respectively, and they are not interchangeable. It is an interesting piece of versatility, but why have three ways to save and load programs?

CSave is the standard method, and it saves a tokenised verison of the Basic program. Tokenisation takes place when you press Return at the end of a line, which is why, if you type in SE. and then list the line, the Basic comes back with the full Setcolour. That is, it just holds a token, and it looks up the meaning of that token; it has no idea what you originally typed.

The big advantage of using tokens is that it is very memory-efficient because each token, with a couple of exceptions, takes up only one byte of RAM. Setcolour takes up only one byte. Long variable names like Netcost take up only one byte per use, after the first use.

There are three types of token, except for a couple of special cases. The three types are keywords, operators and variable names. Keywords can only be the first entry of a statement and Basic then supplies an invisible Let if you do not enter one.

Operators like + and = will be mixed up with variable names in the rest of each statement. The spottable difference between them is that operators have their upper bit off and variable names have it on. This means it is possible to have 128 variable names in a program and the tokens will run from 128 to 255 — one-byte numbers with the upper bit on.

So how does Basic know which variable name that byte stands for? Easy: it looks it up in the variable-name table, which has a starting address found from

PEEK(136) + 256* PEEK(137)

Each time you type in a new variable name Basic gives it a number and keeps a record of what it stands for — Netcost or whatever. This obviously has a memory overhead which has to be taken into account in addition to the one-byte cost per use.

A number of implications follow. First, the variable names are held in the order you typed them in, not the order they occur in the program. Second, if you mistype a name and press Return, the mistyped word is also added to the variable-name table. Third, it is much more memory efficient to use variables than to use binary-coded decimal numbers taking up six bytes each. And fourth, when you have finished the program it does not matter what the variable names are. They need not even be different.

Screen save

Bob McConaghie has also sent a useful Screen Save utility. Like Archimedes' hat, some graphics screens take a considerable time to draw. The utility uses the central I/O described in the operating-system manual. It is run by a small machine-code routine which is created by reading the Data statement. After running the program, type Print M$ and look at the result. Our inability to print it out prevents you from entering it directly.

The next part of the program draws something on a Graphics 8 screen with no text window. It means BufLen is equal to 7,680 bytes, the length of the screen memory.

The utility itself starts at line 1000. It only requires you to tell it how much memory to save, BufLen, and that M$ contains the machine-code routine that calls CIO to perform the Save. To save to cassette instead of to disc just change D:Name to "C:".

What about the load routine? Well, that is exactly the same, except for two Poke values and the fact that you change 8, which means Output, to 4, which means Input as follows:

OPEN # 1,4,128,"D:SCREEN.SAV"

(continued on next page)

Screen save.

```
10 DIM M$(6):REM Needed for small
20 REM machine code routine
30 FOR L=1 TO 6:READ A
40 M$(L,L)=CHR$(A):NEXT L
50 DATA 104,162,16,76,86,228
99 REM Small routine for demonstration
100 GRAPHICS 24
110 SETCOLOR 2,0,0
120 COLOR 1:REM Draw using colour one
130 FOR L=0 TO 156 STEP 4
140 PLOT L+80,0:DRAWTO 236,L
150 PLOT 80,L:DRAWTO L+80,156
160 NEXT L
170 BUFLEN=7680
190 GOSUB 1000
200 END
300 REM ERROR HANDLING
305 REM Should only be necessary when
306 REM restoring saved information
310 POP :REM Remove RETURN entry from stack
320 GRAPHICS 0
330 PRINT "ERROR-  ";PEEK(851)
340 END
1000 REM SCREEN SAVE UTILITY
1010 REM Ensure that both M$ and BUFLEN
1015 REM are set before coming here
1020 HI=INT(BUFLEN/256)
1030 LO=BUFLEN-HI*256
1040 OPEN #1,8,128,"D:SCREEN.SAV"
1050 POKE 850,11
1060 POKE 852,PEEK(88)
1070 POKE 853,PEEK(89)
1080 POKE 856,LO
1090 POKE 857,HI
1100 POKE 858,8
1110 REM All set now call CIO
1120 X=USR(ADR(M$))
1130 IF PEEK(851)<>1 THEN 300:REM ERROR
1140 CLOSE #1
1150 RETURN
```

```
CHANGE THESE LINES FOR
THE LOAD ROUTINE


1050 POKE 850,7
1100 POKE 858,4
```

(continued from previous page)
Or, again, use "C:" for cassette instead.

Now, send in your programs so we can all benefit from that nifty routine you have burnt midnight oil on.

List "C:"

The difference between CSave and List "C:" is that a Listed program is still in ASCII character format and not tokenised, as is obvious if you list a program on the screen. Listing it to the cassette works in the same way. The disadvantage is that for various reasons it is slow and takes up much more tape. But you can use it to perfect your program typing, and it also allows you to merge programs together.

Take a program you have CSaved and CLoad it, then use Print Fre(0) to find the amount of RAM you have left. Save the program to another tape using List "C:", then type New to clear RAM. Rewind the tape and type Enter "C:" to reload the Listed version.

Now you should find that the program takes up less RAM, because when the lines were Entered, it was exactly as though the program had been typed in afresh. If you inspect the variable-name table the variable names will be in the order they appear in the program. Now CSave the program for future use. If you are a poor typist you will be surprised how much memory this routine saves.

Note that before Entering a program you type New, whereas you do not have to do so if you type CLoad. CLoading a program automatically clears the previous one, whereas Entering one does not, so you can merge programs or add standard subroutines from tape, as long as both programs have different line numbers. If two lines have the same number, the last one entered replaces the previous one exactly as it does when you are writing a program.

At this point you may wonder why I have not given you a complicated routine to inspect the variable name table. The reason is that there is a very simple way of doing it. The Atari has a wonderfully simple I/O system where each device is addressed by a single letter:

E — the keyboard/screen editor
K — the keyboard alone
S — the screen alone
P — the printer
C — the cassette recorder
D — the disc drive.

If you want to send something to a different device you only have to change one letter. You can use these cassette routines with disc; or Save a program to the keyboard, though this is not a lot of use. However, as well as Listing a program to cassette you can Save one to the screen.

If you simply type Save "S:" a tokenised version of your program will be displayed. Write a three-line program using the variable names Ted, Bert and Ernie and do this. Among the mess of tokens at the top of the screen, the variables will be there in character form. That's the variable-name table.

Using Save "C:" instead of CSave is simply using the general I/O instead of the CSave system. It also saves the program in tokenised form, but I'm not sure what else it implies. There is a bug in Atari Basic: sometimes the cassette buffer is not cleared, preventing CSave from working properly.

The buffer can be cleared by issuing an LPrint statement first because Basic uses IOCB#7 for all CLoad, CSave and LPrint operations, as explained on page 23 of the manual. If you don't have a printer, don't worry: LPrint will merely produce a harmless error message. Save "C:" seems to avoid this bug in CSave.

Quick tricks

One way to save memory by using tokens instead of floating-point numbers is to write a subroutine on the lines of:

N1 = 1:N2 = N1 + N1:N3 = N2 + N1:N4 = N2 + N2:N5 = ...

Then each time your program needs a number, use your variable instead:

10 FOR X = N2 TO N10 STEP N2

essentially adding an integer format that Atari Basic lacks.

A more interesting idea is to change all the variables in a program to the same variable. It was described by Bill Wilkinson in his Insight: Atari column in October 1981's *Compute!* The listing shows a program by John Wiley of Microbits in Albany, Oregon which changes every character in the variable-name table into a Linefeed CHR$(155), effectively hiding the variable and making the program unreadable. What's more, it effectively deletes itself afterwards.

Lines 32700-30 change the line numbers of the listing so line numbers bigger than 32512, high byte 127, are greater than 32768, high byte 128. Basic does not know about line numbers higher than 32767.

The listing contains only 10 statements. Type it in and List it to tape. Load your program and then Enter the routine. Type Goto 32600 to run it, then save your working but incomprehensible-looking program in the normal way.

Quick tricks.

```
32600 START=PEEK(130)+256*PEEK(131)
32610 VEND=PEEK(132)+256*PEEK(133)
32620 FOR X=START TO VEND
32630 POKE X,155
32640 NEXT X
32700 X=PEEK(136)+256*PEEK(137)
32710 X=X+1
32720 IF PEEK(X)>126 THEN POKE X,128:END
32730 X=X+PEEK(X+1):GOTO 32720
```

Effects of Quick tricks listing.

```
5 REM ORIGINAL PROGRAM
10 PRINT CHR$(125):REM CLEAR SCREEN
20 POKE 752,1:POSITION 10,10
30 PRINT "PRACTICAL COMPUTING"
40 A=INT(255*RND(1))+1:B=INT(255*RND(1))+1
50 FOR C=1 TO 5:POKE 710,A:POKE 712,B
60 SOUND 0,A,10,8:SOUND 1,B,10,8:NEXT C
70 GOTO 10
```

```
CORRUPTED USING CHR$(65) OR A
INSTEAD OF CHR$(155) OR LINEFEED
```

```
5 REM CORRUPTED LISTING
10 PRINT CHR$(125):REM CLEAR SCREEN
20 POKE 752,1:POSITION 10,10
30 PRINT "PRACTICAL COMPUTING"
40 bCORRUPTED LISTING
=INT(255*RND(1))+1:AAAAAAAAAAAAAAAA@A=INT
 (255*RND(1))+1
50 FOR AvvAv=1 TO 5:POKE 710,bCORRUPTED
 LISTING
:POKE 712,AAAAAAAAAAAAAAAA@A
60 SOUND 0,bCORRUPTED LISTING
,10,8:SOUND 1,AAAAAAAAAAAAAAAA@A,10,8:
  NEXT AvvAv
70 GOTO 10
```

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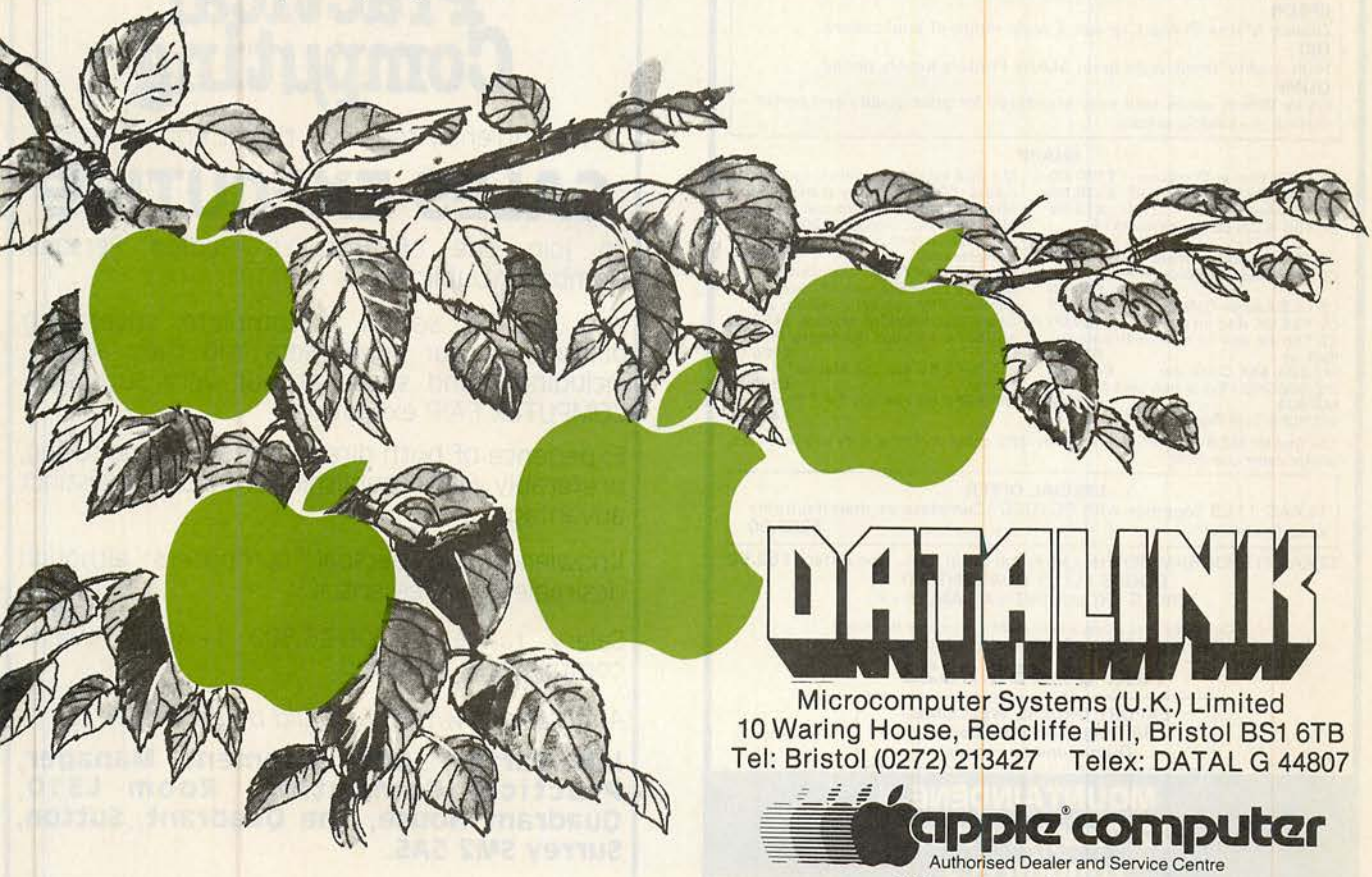

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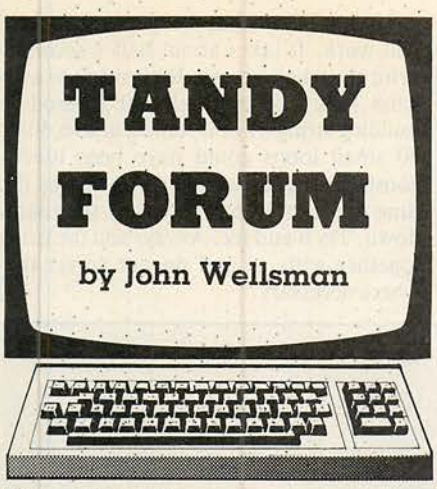

Noise input

HERE IS an item to control the world with your TRS-80, sent by Dr J S Lowe of Keyworth, Nottingham. He describes it as "speech input made easy", but to be accurate, for "speech" use "noise". No special equipment is required; all you need is a tape recorder with its own microphone, a level II keyboard and the standard connecting leads.

First, connect up the cassette recorder as usual, except that the cassette input plug need not be used. If the recorder does not have a built-in microphone plug in an external one.

Then press in the record tab sensor, and press the Record and Play keys as if for recording.

Then, press in the record tab sensor and press the Record and Play keys as if for recording. Video Genie users need an external cassette recorder, using the leads from the second cassette interface. The cassette is now actively picking up sounds from the microphone and feeding signals into the computer to port 255, the cassette Read/ Write port. To detect an input you use the function Inp(255). To see if it is working, try running this program and then tapping or shouting at the microphone:

```
10 CLS
20 IF INP(255) = 255 THEN PRINT @ 488,
   "NOISE": FOR N = 1 TO 1000 : NEXT
   N:GOTO 10 ELSE GOTO 20
```

The word "noise" will appear on the screen as soon as a noise occurs. Note that while no noise occurs a loop is set up inside line 20, but directly a noise does occur whatever response you have set up occurs. The port must be reset before it can be tripped again. It is achieved by the commands CLS, Clear or Print CHR$(23).

Dr Lowe states that Inp(255) works fine on his Video Genie in spite of the fact that the second cassette interface is supposed to operate through port 254.

Program protection

This little program will enable you to give your programs a lot of protection. It demonstrates a way of preventing the unauthorised Listing or LListing of your coding. Line 60 puts on the blinkers and line 120 will take them off again.

One snag is that you cannot use an ordinary Input function when you use this lock. Use an Inkey$ routine instead as in lines 70 to 90. However, if you are using Disc Basic, the snag becomes a little more serious when you Input from a file, because the same problem occurs. The program ends.

The only way to get over it is to invoke the Poke in line 120 immediately before the Input, and then invoke the Pokes in line 60 immediately afterwards. There is one other snag. It can only be effective with people who do not read *Practical Computing*.

Tandy

Tandy model I and III users are most fortunate in their wide choice of disc operating systems. They have in addition to Tandy's own TRS-DOS, NewDos 2.1, NewDos 80 versions 1 and 2, L-Dos and its little brother and others not generally available in the U.K. Apart from NewDos 2.1, which the authors at Apparat conceded was a rewrite of TRS-DOS with amendments and embellishments, all the others are independent creations, though to a greater or lesser extent they include some of the TRS-DOS's external architecture. Some of the utilities offered by these systems take a lot of learning, and I would not advise anyone to change their DOS merely because a new and more fashionable one has appeared on the scene.

The various system options on NewDos 80 seem to give people trouble. What is often forgotten is that you must reboot immediately after setting the parameters — they will not work until and unless this is done.

New data for old

Andrew Parsonage of Saltney Ferry, Chester has worked out a way of recording a single item of data in a program and altering it, if necessary, each time the program is used. As it stands, it can only be used with model I, level 2.

The essential factor is that the line containing the data must be the first line in the program, though the line number is immaterial. Another restriction is that the new data must be the same length as the old data. It can be less, and this is taken care of in lines 130 and 140. Then in line 150 the new data is Poked into the address of the old data.

If the data is numerical it can be read in line 170 as Val (ND$) and the padding zeros will be ignored. If the data is a text string then instead of adding zeros, substitute a CHR$(128), which is a space. It will not work with Disc Basic as programs do not always start at the same address. However, the starting point can be found at addresses 16548, least-significant byte, and 16549, most significant byte, and the address to be Poked should be six addresses above this. With the use of LineInput, it is possible to poke in more than one item of data.

Andrew Parsonage suggests that this routine could be useful in games, for instance, recording the highest score. But it could also be used for more serious purposes, such as automatically recording the number of times that a program has been used.

Speedier graphics

M K Offen of Newcastle upon Tyne, sent a most interesting account of his experiments with strings in the graphics field. He makes the important point that if you have a complex graphic design to display on the screen, it is far quicker and much more striking to build up the display into one or more very large string variables, and then print them, rather than laboriously define and print a display one character at a time.

For instance:-

```
10 FOR X = 1 TO 64
20 A$ = A$ + CHR$(191)
30 NEXT:PRINT A$
```

is faster in the actual display than

```
10  FOR X = 1 TO 64
20 PRINT CHR$(191);
30 NEXT
```

These two loops only illustrate building large strings. When only one character is used, Print String$(64,191) would be the way to perform the operation of the first loop. To show the use of large string variables, which can hold up to 255 characters, Mr Offen gives a program which draws a simple pictograph-type map — see listing 1.

(continued on next page)

Noise input.

```
1 DATA 000000
110 INPUT"NEW DATA";ND$
120 RESTORE:READ ED$
125 'GOTO 200
130 IF LEN(ND$))LEN(ED$) THEN
   PRINT"ERROR. NEW DATA LANGER
    THAN EXISTING DATA.":STOP
140 IF LEN(ED$)=LEN(ND$) THEN 150
   ELSE ND$="0"+ND$:GOTO 140
150 FOR C= 1 TO LEN(ND$):POKE
   C+17134,ASC(MID$(ND$,C,1)):
NEXT C:
160 RESTORE:READ ND$
170 PRINT"NEW DATA READS";ND$
180 STOP
```

(continued from previous page)

There is some delay in building the string A$, but once it is completed it can repeatedly be printed on the screen with no delay at all. If a display is used in a game, the time spent in building the string can be hidden by printing directions on the screen. By the time they have been read the string will be complete.

From an operating point of view, a rather quicker way is to build up each line or part of a line into a string by adding the actual characters, then adding the strings up to a maximum of 255 characters. With four such giant characters you can cover the entire screen, except for four characters. Printing these will come a very good second to a machine language display. The disadvantage is that the planning and coding of the program takes a lot of thought and time, but the results are well worth the effort made.

Listing 2 illustrates the speed at which this will work. It takes about half a second to print the whole screen. Remember to avoid what look like more elegant methods of building strings. For instance, in lines 50 and 60 small loops could have been used to construct the large strings. But loops take time and can perceptably slow the routine down. Try it and see. Always add the strings together with + and do not forget the ; where necessary.

Program protection.

```
10 ' THIS IS A DEMO OF THE LIST
AND LLIST DISABLE ROUTINE
20 ' THE NORMAL "INPUT" FUNCTION
WITH THIS BRINGS THE PROG TO AN
END SO AN INKEY$ FUNCTION MUST
BE USED INSTEAD - SEE LINES 70 -
90
30 CLS:PRINT@192,"TO GO BEYOND
THIS LINE WILL DISABLE THE LIST
& LLIST FUNCTION."
40 PRINT:PRINT"PRESS ANY KEY TO
CONTINUE"
50 J$=INKEY$:IF J$="" THEN 50
60 POKE16863,195:POKE
16864,114:POKE 16865,0
70 PRINT@448,"ENTER YOUR NAME"
80 I$=INKEY$:IF I$="" THEN 80 ELSE
  IF I$=CHR$(13) THEN 90 ELSE
 A$=A$+I$:PRINTI$;:GOTO 80
90 PRINT@576,"YOUR NAME IS ";A$:
100 PRINT@704,"THIS ENDS THE
   PROGRAM. NOW TRY AND LIST IT.":
110 PRINT:PRINT"IF YOU CAN'T, TYPE
   ";CHR$(34);"RUN 120";CHR$(34);
  " AND TRY AGAIN.":END
120 POKE 16863,201
```

Speedier graphics — listing 1.

```
1 CLS:CLEAR 100
10 CLEAR 510
15 FOR Y=1 TO 15
20 FOR X=1 TO 15
30 READ N$
40 IF N$="W" THEN A$=A$+CHR$(191):
  GOTO 80
50 IF N$="S" THEN A$=A$+" ":GOTO
  80
60 IF N$="A" THEN A$=A$+"*":GOTO
  80
70 IF N$="T" THEN A$=A$+"T"
80 NEXT
90 A$=A$+CHR$(10)
100 NEXT
110 CLS:PRINTCHR$(23);A$;
120 GOTO 120
1000 DATAW,W,W,W,W,W,W,W,W,W,W,
    W,W,W
1010 DATAW,S,S,S,S,A,T,T,S,S,S,S,
    S,S,W
1020 DATAW,S,S,S,S,T,A,A,T,T,S,S,
    S,S,W
1030 DATAW,S,S,S,T,T,T,A,T,T,T,S,
    S,S,W
1040 DATAW,S,S,S,T,T,T,A,A,T,T,T,
    S,S,W
1050 DATAW,S,S,S,T,T,T,T,A,T,T,T,
    S,S,W
1060 DATAW,S,S,S,S,T,T,T,A,A,A,T,
    T,T,W
1070 DATAW,S,S,S,S,T,T,T,T,T,A,T,
    T,T,W
1080 DATAW,S,S,S,S,S,T,T,T,T,A,A,
    T,T,W
1090 DATAW,S,S,S,S,S,S,T,T,T,T,A,
    T,T,W
1100 DATAW,S,S,S,S,S,S,S,T,T,T,A,
    A,T,W
1110 DATAW,S,S,S,S,S,S,S,S,T,T,T,
    A,T,W
1120 DATAW,S,S,S,S,S,S,S,T,T,T,T,A,
    T,T,W
1130 DATAW,S,S,S,S,S,S,S,S,T,T,T,A,
    T,T,W
1140 DATAW,W,W,W,W,W,W,W,W,W,W,W,
    W,W,W
```

Speedier graphics — listing 2.

```
1   CLEAR 1500:CLS
5   A=RND(40):B=RND(40):C=RND(40):
    D=RND(40)
20 A$=STRING$(4,166)+
  STRING$(4,32):A$=A$+A$
30 B$=STRING$(4,32)+
STRING$(4,166):B$=B$+B$
50 A$=A$+A$+A$+A$:B$=B$+B$+B$+B$
60 PRINTA$;B$;A$;B$;A$;B$;A$;B$;
1000 C$=CHR$(160)+CHR$(190)+
    CHR$(180)+STRING$(4,32):
  C$=C$+C$+C$
1010 PRINTSTRING$(A,32);C$: PRINT
     STRING$(B,32);C$:PRINTSTRING$
     (C,32);C$:PRINTSTRING$(D,32);
    C$
```

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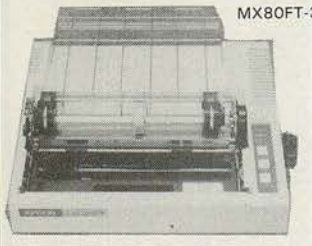

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BBC BYTES

by John Harris

Caterpillar

THE GAMES sent to BBC Bytes are certainly varied: Shingo Sugiura of Putney sent in one that beeps and trills in a satisfactory fashion, speeds up in the currently accepted games mode as progress is made and severely penalises inattention.

The ecological description posits a hungry caterpillar needing guidance toward fresh food buds. Contact with big black blocks of insecticide, of which the world boundary is also composed, proves instantly lethal. On adequately depleting its environment of sustenance the caterpillar passes to another plane of existence, or screen, where surrounded by replenished stocks it tucks in.

Screen dump

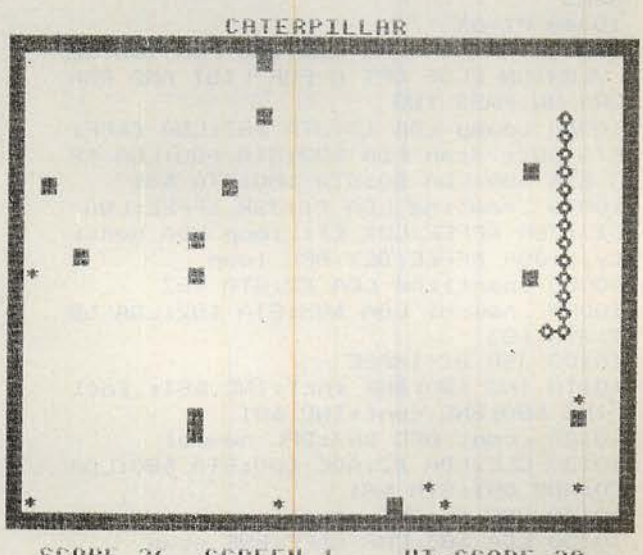
If all readers of this column were kitted out with identical hardware I could be sure that the programs would work for everyone. Last month there was a text-dump routine which works fine on 80-column printers, but only because the Carriage-Return commands, VDU 1,13, had been de-selected.

Some users will only get satisfactory results by selecting the two occurrences, VDU 2,1, 13,3, while others will need to include Linefeeds as well, VDU 2,1, 13,1,10,3. I have not heard of anyone needing any other permutation. This is general to all the programs with print op-

(continued on next page)

Caterpillar.

```
   10REM ***CATERPILLAR***
   20REM (C) SHINGO SUGIURA
   30MODE7:DIMX%(17):DIMY%(17)
   40HI%=30:SCORE%=0:SCREEN%=1
   50PROCINSTRUCTIONS
   60MODE1:COLOUR 130:VDU23;10,32;0;0;
0;
   70PROCINIT:CLS
   80PROCWALL
   90PROCOBSTACLES
  100PROCFOOD
  110IF INKEY(-98)=-1 THEN A$="LEFT"
  120IF INKEY(-67)=-1 THEN A$="RIGHT"
  130IF INKEY(-73)=-1 THEN A$="UP"
  140IF INKEY(-105)=-1 THEN A$="DOWN"
  150PRINTTAB(X%(LGTH%),Y%(LGTH%));" "
  160IF A$="LEFT" THEN X%(1)=X%(1)-1
  170IF A$="RIGHT" THEN X%(1)=X%(1)+1
  180IF A$="UP" THEN Y%(1)=Y%(1)-1
  190IF A$="DOWN" THEN Y%(1)=Y%(1)+1
  200PROCCALCULATE
  210VDU26
  220COL%=POINT(X%(1)*32+16,(31-Y%(1))
*32+26)
  230IF COL%<>2 THEN PROCCHECK
  240PROCANIMATE
  250COLOUR0:PRINTTAB(9,30);SCORE%
  260GOTO110
  270DEFPROCINSTRUCTIONS
  280PRINTTAB(13,1);CHR$141"CATERPILLA
R"
  290PRINTTAB(13,2);CHR$141"CATERPILLA
R"
  300PRINTTAB(10,3);"BY  SHINGO SUGIUR
A"
  310PRINTTAB(1,7);"YOU MUST GUIDE THE
 HUNGRY CATERPILLAR"
  320PRINTTAB(1,8);"TOWARDS THE FRESH
BUDS WHILE AVOIDING"
  330PRINTTAB(1,9);"THE INSECTICIDE BL
OCKS."
  340PRINTTAB(1,10);"IF YOU TRY TO GUI
DE HIM BACKWARDS HE"
  350PRINTTAB(1,11);"WILL TWIST HIS LE
GS AND DIE."
  360PRINTTAB(14,13);"CONTROLS:-"
  370PRINTTAB(12,15);"UP----------";"
  380PRINTTAB(12,16);"DOWN--------";"
  390PRINTTAB(12,17);"LEFT--------";"
  400PRINTTAB(12,18);"RIGHT-------";"
  410PRINTTAB(7,20);"PRESS ANY KEY TO
START":A$=GET$
  420ENDPROC
  430DEFPROCINIT
  440ENVELOPE1,1,3,2,-2,6,6,6,100,0,0,
-5,100,0
  450VDU23,224,255,255,255,255,255,255
,255,255
  460VDU23,225,24,60,126,231,231,126,6
0,24
  470VDU19,1,2;0;19,3,6;0;
  480A$="RIGHT":LGTH%=3
  490FOR INIT=1TO17:Y%(INIT)=15:NEXTIN
IT
  500FOR INIT=1TO17:X%(INIT)=INIT+1:NE
XTINIT
  510ENDPROC
  520DEFPROCCALCULATE
  530FOR CAL%=17 TO 2 STEP -1
  540X%(CAL%)=X%(CAL%-1)
  550Y%(CAL%)=Y%(CAL%-1)
  560NEXTCAL%:ENDPROC
  570DEFPROCANIMATE:COLOUR1
  580FORANI%=1TOLGTH%
  590PRINTTAB(X%(ANI%),Y%(ANI%));CHR$2
25
  600NEXT ANI%:ENDPROC
  610DEFPROCCHECK
  620IFCOL%=0 OR COL%=1 THEN PROCDEAD
  630IF COL%=3 THEN SCORE%=SCORE%+2:SO
UND1,1,100,2
```



(listing continued on next page)

(continued from previous page)

tions in this column, and I shall try to point out the problem areas as and when they arise.

This month I have a complementary screen dump routine from Simon Letts of Warrington. Rather than incorporate these routines in programs, it can be easier to precede them with a print select, VDU 2, ProcRoutine and End, making them into stand-alone programs. Then Chain at the appropriate point in the main program, when the screen contents are to be reproduced on the printer. There are situations when having the routines immediately available is a necessity.

The routine will dump, in high resolution, the contents of the screen on to an Epson MX-100F/TIII printer. If you have a non-Epson printer you will doubtless relish the challenge of amending the control codes to achieve the desired results on your own gear. Epson MX-80III users will find the CR generated by .newline in line 10070 will need removing. Mk II owners should find the control codes used are identical and that the routine works with the same amendment.

Since the printer cannot handle colour the routine must make some compromise, and the convention adopted is that all odd-numbered logical colours are printed as white and evens as black. This can be reversed as shown in line 10250 if you so desire.

The procedure must be assembled by using ProcAssem, after which ProcMC-Dump can be used at any time to dump the current screen contents.

(listing continued from previous page)

```
  640LGTH%=LGTH%+1
  650IFSCREEN%*28=SCORE% THEN PROCUPDA
TE
  660ENDPROC
  670DEFPROCWALL:COLOUR0
  680PRINTTAB(14,1);"CATERPILLAR"
  690PRINTTAB(3,31);"SCORE ";SCORE%
  700PRINTTAB(13,30);"SCREEN ";SCREEN%
  710PRINTTAB(25,30);"HI-SCORE ";HI%
  720FOR WALL=1 TO 38
  730PRINTTAB(WALL,1)CHR$224
  740PRINTTAB(WALL,28)CHR$224
  750NEXT WALL
  760FOR WALL=1 TO 28
  770PRINTTAB(1,WALL)CHR$224
  780PRINTTAB(38,WALL)CHR$224
  790NEXT WALL
  800ENDPROC
  810DEFPROCOBSTACLES
  820FOR OBS=1 TO SCREEN%*4+10
  830PRINTTAB(RND(34)+1,RND(27)+1)CHR$
224
  840SOUND0,-15,6,1
  850FOR DELAY=1 TO 100:NEXT DELAY
  860NEXT OBS:ENDPROC
  870DEFPROCFOOD:COLOUR 3
  880FOR FOOD=1 TO 20
  890FOR DELAY=1 TO 80:NEXT DELAY
  900SOUND1,-10,RND(200),1
  910PRINTTAB(RND(34)+1,RND(26)+1)"*"
  920NEXT FOOD:ENDPROC
  930DEFPROCUPDATE:SCREEN%=SCREEN%+1
  940GOTO70:ENDPROC
  950DEFPROCDEAD:IF SCORE%>HI% THEN HI
%=SCORE%
  960PRINT''"DEAD":*FX15,0
  970RESTORE1040
  980FOR MUSIC=1 TO 11
  990READ A,B,C
 1000SOUND3,-10,A,B:FOR REST=1 TO C:NE
XT REST
 1010NEXT MUSIC:SCREEN%=1:SCORE%=0
 1020PRINT"TRY AGAIN?":ANS$=GET$:IF AN
S$="Y" THEN 70
 1030IF ANS$<>"N" THEN 1020
 1040DATA61,10,1000,61,8,700,61,4,550,
61,12,950,73,8,600,69,7,650
 1050DATA69,9,800,61,5,500,61,10,100,5
7,7,100,61,20,10
```

Screen dump.

```
>LOAD "A.LETTS"
>LIST
10000 DEF PROCASSEM
10010 VDU14:REM PAGE MODE ON
10020 DIM Q% 150
10030 FOR C=0 TO 3 STEP 3:REM TWO PA
SSES
10040 P%=Q%
10050 [OPT O \ NO LISTING FOR TESTED
 VERSION ELSE OPT C FOR LIST AND ERR
ORS ON PASS TWO
10060 .dump LDA £3:STA &83:LDA £&FF:
STA &82:.scan LDA &82:STA &88:LDA &8
3:STA &89:LDA £0:STA &80:STA &81
10070 .newline LDA £1:JSR &FFEE:LDA
£13:JSR &FFEE:LDX £7:.loop LDA densi
ty,X:JSR &FFEE:DEX:BPL loop
10080 .partline LDA £2:STA &87
10090 .newcol LDA &88:STA &82:LDA &8
9:STA &83
10100 JSR BITIMAGE
10110 INC &80:BNE incl:INC &81:.incl
 INC &80:BNE cont:INC &81
10120 .cont DEC &87:BPL newcol
10130 CLC:LDA £2:ADC &80:STA &80:LDA
£0:ADC &81:STA &81
10140 CMP £5:BNE partline
10150 LDA &83:CMP £&FF:BNE scan
10160 RTS \ END OF MAIN PROGRAM
10170 .BITIMAGE LDA £0:STA &86
10180 LDA £7:STA &85
10190 .loop LDX £&80:LDY £0
10200 LDA £9:JSR &FFF1
10210 LSR &84:ROL &86
10220  LDA &82:BNE DEC1:DEC &83:.DEC
1 DEC &82
10230 LDA &82:BNE DEC2:DEC &83:.DEC2
 DEC &82
10240 DEC &85:BPL loop
10250 LDA £1:JSR &FFEE:LDA &86:\ EOR
 £&FF \REMOVE FIRST \ TO PRINT WHITE
 ON BLACK (AS SCREEN)
10260 JMP &FFEE
10270 .density:]NEXT
10280 REM DATA FOR BIT IMAGE DENSITY
10290 !P%=&01E00101:!(P%+4)=&011B014
B
10300 ENDPROC
10310 DEFPROCMCDUMP
10320 *FX5,1
10330 REM CLEAR PRINTER-SET LINE SPA
CING(23/216")
10340 VDU1,13,1,27,1,51,1,23
10350 MOVE0,0
10360 CALL dump
10370 VDU1,27,1,50:REM RESTORE LINE
SPACING
10380 ENDPROC
```

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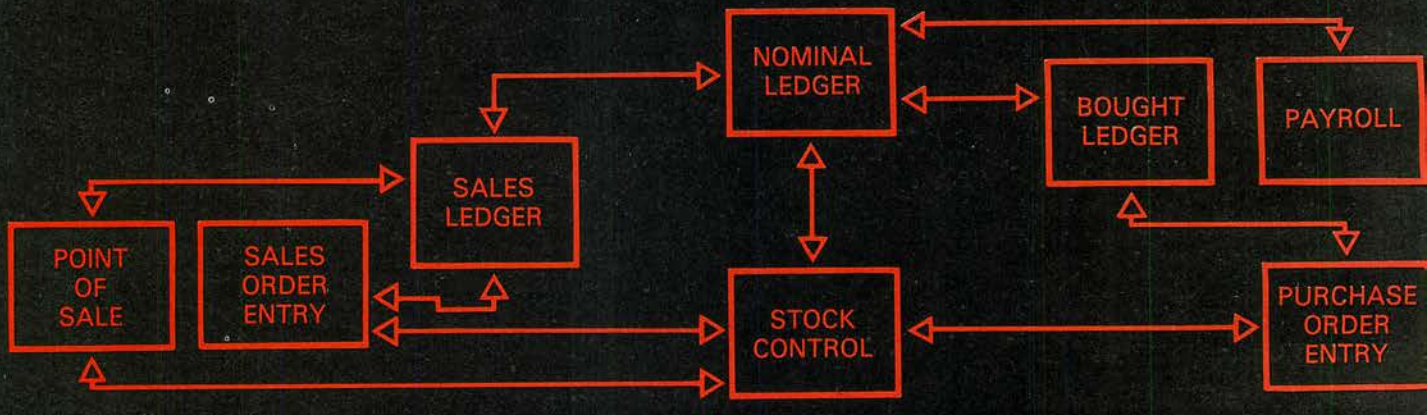

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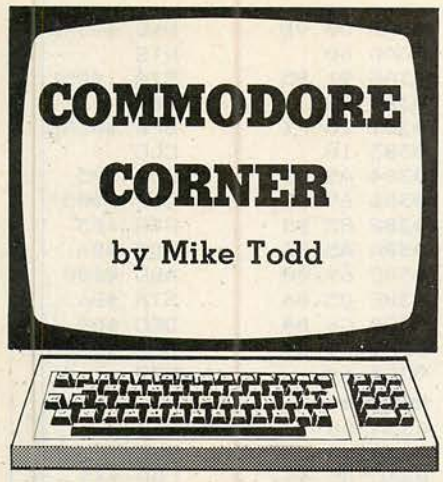

Simple Sorting

IN PRACTICAL COMPUTING'S Pet Corner, May 2981, we published a string sort routine by Simon Letts of Warrington. Now he has written two more sort routines, which will sort integer or floating-point arrays.

For each there is a Basic loader program and a disassembly. I have written simple checksum into the Basic loader, which adds up all the numbers in the Data statements and checks the total against the final Data value. If there is a discrepancy, then there is a number wrong somewhere. If the program works without any error message, then you can be sure that you have typed it in correctly.

The machine-code routines are fully relocatable, since they contain no absolute address references to themselves, and will work on Basic 2, 3 or 4 Pets. Like the original string sorts they are limited to 255 items. To use the routine, set element 0 in the array to the start address of the routine, A(0) = 826 if used as shown, and then execute.

POKE 180,C : SYS A(0)

where C is 1 less than the number of items to be sorted. For integer sort use A%(0).

Putting the Sys address in the first element of the array guarantees that the pointers to the array are already set up when the routines are entered, and saves having to search for them. If you need to use this first

(continued on next page)

Floating sort loader.

```
1 REM ******************************
2 REM *                            *
3 REM *  FLOATING SORT - LOADER    *
4 REM *                            *
5 REM ******************************

10 FOR I = 826 TO 964
11 READ A : POKE I, A
12 Q=Q+A
14 NEXT I
15 READ A: IF Q<>A THEN PRINT"CHECKSUM ERROR"

1000 DATA 216,  24, 165,  68, 105,   5, 133, 181, 165,  69, 105,   0, 133, 182
1010 DATA 166, 180, 165, 181, 133, 183, 133, 185, 165, 182, 133, 184, 133, 186
1020 DATA  24, 165, 185, 105,   5, 133, 185, 165, 186, 105,   0, 133, 186, 160
1030 DATA   1, 177, 185,  81, 183,  16,   6, 177, 183,  48,  48,  16,  38, 177
1040 DATA 183,  16,  17, 160,   0, 177, 185, 209, 183, 144,  34, 208,  24, 200
1050 DATA 192,   5, 208, 243, 240,  25, 160,   0, 177, 183, 209, 185, 144,  17
1060 DATA 208,   7, 200, 192,   5, 208, 243, 240,   8, 165, 185, 133, 183, 165
1070 DATA 186, 133, 184, 202, 208, 180, 160,   4, 177, 183, 133, 179, 177, 181
1080 DATA 145, 183, 165, 179, 145, 181, 136,  16, 241,  24, 165, 181, 105,   5
1090 DATA 133, 181, 165, 182, 105,   0, 133, 182, 198, 180, 208, 132,  96
2000 DATA 18856
```

Integer sort loader.

```
1 REM ******************************
2 REM *                            *
3 REM *  INTEGER  SORT - LOADER    *
4 REM *                            *
5 REM ******************************

10 FOR I = 826 TO 941
11 READ A : POKE I,  A
12 Q=Q+A
14 NEXT I
15 READ A: IF Q<>A THEN PRINT"CHECKSUM ERROR"

1000 DATA 216,  24, 165,  68, 105,   2, 133, 181, 165,  69, 105,   0, 133
1010 DATA 182, 166, 180, 165, 181, 133, 183, 133, 185, 165, 182, 133, 184
1020 DATA 133, 186,  24, 165, 185, 105,   2, 133, 185, 165, 186, 105,   0
1030 DATA 133, 186, 160,   0, 177, 185,  81, 183,  16,   6, 177, 183,  48
1040 DATA  25,  16,  15, 177, 183, 209, 185, 144,  17, 208,   7, 200, 192
1050 DATA   2, 208, 243, 240,   8, 165, 185, 133, 183, 165, 186
1060 DATA 133, 184, 202, 208, 203, 160,   1, 177, 183, 133, 179, 177, 181
1070 DATA 145, 183, 165, 179, 145, 181, 136,  16, 241,  24, 165, 181, 105
1080 DATA   2, 133, 181, 165, 182, 105,   0, 133, 182, 198, 180, 208, 155,  96
2000 DATA  15850
```

Simple Sorting. Table 1.

Integer sort				Floating sort		
036D	036F	0372	0374	036D	036D	0373
30	10	B7	B9	30	10	10 Ascending
10	30	B9	B7	10	30	30 Descending

(continued from previous page)
element of the array, set the value of 033F to zero. It can be done by changing one value in line 1000. For the floating sort, change the 5 to a 2, and for the integer sort change the 2 to 0 and then call

POKE 180,C : A(0) = A(0) : SYS 826

Here the A(0) = A(0) is used to set up the array pointers.

It is possible to change the sorts from ascending to descending sorts by changing

The Exclusive-Or and conditional branch at 0367 to 036A determine whether the current items being compared have the same sign and need to be compared for magnitude, or whether the sign will be used to decide whihc is the smaller number. As the Pet stores the mantissa of floating-point numbers using a sign and magniture method, the floating sort needs two magniture sort comparisons. One for negative number at 0375 to 0385, and one for positive numbers at 0386 to 0396. These sort the numbers into opposite order according to their sign, for example 9 is greater than 5 but −9 is less than −5.

Although the sorts are limited to 255 elements, 256 if you use element 0, I am sure that it would be possible to rewrite the routines, to allow larger arrays to be sorted. I suspect that it would result in the program losing its compactness and portability.
Lists 3C/2a,b,c,d.

Key Wait routine

This program for the Vic-20 by Pieter Hintjens of Edinburgh helps overcome problems that can crop up when a program displays a Hit Any Key prompt. Many programmers find this a convenient way of interacting with the user but are inclined to forget that the user can take it literally, being as likely to hit Stop as A,S,D,F, etc.

The Key Wait routine will loop endlessly until the brave user presses a key — any key, including Stop and Shift, except Restore. The routine should be called at the start of the program, or else after any cassette operations as it resides in the cassette buffer starting at 828.

To use the Wait routine, use a line something like:

230 PRINT "PRESS ANY KEY TO CONTINUE": SYS 828

The program only starts again once the key is released to prevent Stop from halting the run.

Floating sort.

```
033A D8        CLD
033B 18        CLC
033C A5 44     LDA $44
033E 69 02     ADC #$02
0340 85 B5     STA $B5
0342 A5 45     LDA $45
0344 69 00     ADC #$00
0346 85 B6     STA $B6
0348 A6 B4     LDX $B4
034A A5 B5     LDA $B5
034C 85 B7     STA $B7
034E 85 B9     STA $B9
0350 A5 B6     LDA $B6
0352 85 B8     STA $B8
0354 85 BA     STA $BA
0356 18        CLC
0357 A5 B9     LDA $B9
0359 69 02     ADC #$02
035B 85 B9     STA $B9
035D A5 BA     LDA $BA
035F 69 00     ADC #$00
0361 85 BA     STA $BA
0363 A0 00     LDY #$00
0365 B1 B9     LDA ($B9),Y
0367 51 B7     EOR ($B7),Y
0369 10 06     BPL $0371
036B B1 B7     LDA ($B7),Y
036D 30 19     BMI $0388
036F 10 0F     BPL $0380
0371 B1 B7     LDA ($B7),Y
0373 D1 B9     CMP ($B9),Y
0375 90 11     BCC $0388
0377 D0 07     BNE $0380
0379 C8        INY
037A C0 02     CPY #$02
037C D0 F3     BNE $0371
037E F0 08     BEQ $0388
0380 A5 B9     LDA $B9
0382 85 B7     STA $B7
0384 A5 BA     LDA $BA
0386 85 B8     STA $B8
0388 CA        DEX
0389 D0 CB     BNE $0356
038B A0 01     LDY #$01
038D B1 B7     LDA ($B7),Y
038F 85 B3     STA $B3
0391 B1 B5     LDA ($B5),Y
0393 91 B7     STA ($B7),Y
0395 A5 B3     LDA $B3
0397 91 B5     STA ($B5),Y
0399 88        DEY
039A 10 F1     BPL $038D
039C 18        CLC
039D A5 B5     LDA $B5
039F 69 02     ADC #$02
03A1 85 B5     STA $B5
03A3 A5 B6     LDA $B6
03A5 69 00     ADC #$00
03A7 85 B6     STA $B6
03A9 C6 B4     DEC $B4
03AB D0 9B     BNE $0348
03AD 60        RTS
03AE 91 B5     STA ($B5),Y
03B0 88        DEY
03B1 10 F1     BPL $03A4
03B3 18        CLC
03B4 A5 B5     LDA $B5
03B6 69 05     ADC #$05
03B8 85 B5     STA $B5
03BA A5 B6     LDA $B6
03BC 69 00     ADC #$00
03BE 85 B6     STA $B6
03C0 C6 B4     DEC $B4
03C2 D0 84     BNE $0348
03C4 60        RTS
```

Integer sort.

```
033A D8        CLD
033B 18        CLC
033C A5 44     LDA $44
033E 69 02     ADC #$02
0340 85 B5     STA $B5
0342 A5 45     LDA $45
0344 69 00     ADC #$00
0346 85 B6     STA $B6
0348 A6 B4     LDX $B4
034A A5 B5     LDA $B5
034C 85 B7     STA $B7
034E 85 B9     STA $B9
0350 A5 B6     LDA $B6
0352 85 B8     STA $B8
0354 85 BA     STA $BA
0356 18        CLC
0357 A5 B9     LDA $B9
0359 69 02     ADC #$02
035B 85 B9     STA $B9
035D A5 BA     LDA $BA
035F 69 00     ADC #$00
0361 85 BA     STA $BA
0363 A0 00     LDY #$00
0365 B1 B9     LDA ($B9),Y
0367 51 B7     EOR ($B7),Y
0369 10 06     BPL $0371
036B B1 B7     LDA ($B7),Y
036D 30 19     BMI $0388
036F 10 0F     BPL $0380
0371 B1 B7     LDA ($B7),Y
0373 D1 B9     CMP ($B9),Y
0375 90 11     BCC $0388
0377 D0 07     BNE $0380
0379 C8        INY
037A C0 02     CPY #$02
037C D0 F3     BNE $0371
037E F0 08     BEQ $0388
0380 A5 B9     LDA $B9
0382 85 B7     STA $B7
0384 A5 BA     LDA $BA
0386 85 B8     STA $B8
0388 CA        DEX
0389 D0 CB     BNE $0356
038B A0 01     LDY #$01
038D B1 B7     LDA ($B7),Y
038F 85 B3     STA $B3
0391 B1 B5     LDA ($B5),Y
0393 91 B7     STA ($B7),Y
0395 A5 B3     LDA $B3
0397 91 B5     STA ($B5),Y
0399 88        DEY
039A 10 F1     BPL $038D
039C 18        CLC
039D A5 B5     LDA $B5
039F 69 02     ADC #$02
03A1 85 B5     STA $B5
03A3 A5 B6     LDA $B6
03A5 69 00     ADC #$00
03A7 85 B6     STA $B6
03A9 C6 B4     DEC $B4
03AB D0 9B     BNE $0348
03AD 60        RTS
```

Key wait routine in Basic, and corresponding op code mnemonics.

```
1000 DATA 173, 141, 2, 208, 16, 165, 197, 201, 64, 240, 245, 165, 197, 201
1010 DATA 64, 208, 250, 169, 0, 133, 198, 96, 234
1020 FOR I = 0 TO 21: READ A: POKE 828 + I, A. NEXT: RETURN

wait:   lda $028D     ; check for shift, chift or control keys
        bne exit      ; if not 0 then one pressed
        lda $C5       ; now look at key pressed
        cmp #$40      ; 64 means no key pressed
        beq wait      ; so go round again
loop:   lda $C5       ; if a key was pressed, wait until
        cmp #$40      ; it is released — this prevents STOP from
        bne loop      ; stopping the program once back in Basic.
exit:   lda #$00      ; cancel any characters
        sta $C6
        rts           ; return control to Basic.
```

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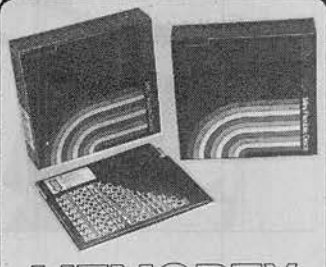

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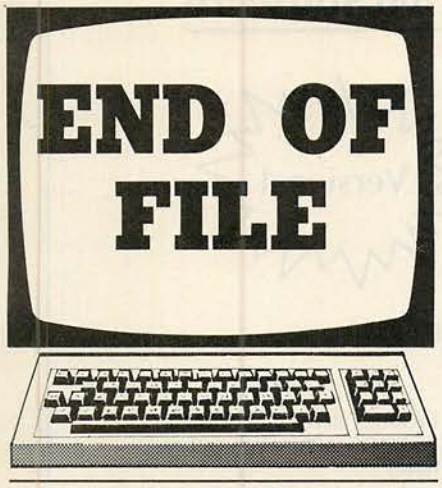

MBASIC ROUTINE

Handling dates

TO STORE a date, three variables are required, one each for the day, month and year, notes Joe Ryan of Killiney, County Dublin, Ireland. For a simple program the storage space so used should be no problem, but in a long program which, for example, includes records containing dates, the amount of storage used to hold the dates could become significant. a routine to sort such records in chronological order would be quite complex. A further problem in working with dates is that the validation of input data is not easy, given that the highest valid day in a month can be 28,29,30 or 31, depending on the month in question.

These two MBasic subroutines simplify all operations associated with inputting, storing, sorting and displaying dates. As an added bonus, the listing includes a function which will return the day-of-week for any date.

The subroutines are at lines 230 and 390 respectively. The first one is called when the input of a date is required: if the date given is outside the range chosen — line 130 — or if it is an invalid date an error message is printed and a new input is sought. This program will work for the years 1901 to 1999, set by Z1 and ZN respectively. The range between Z1 and ZN should not exceed 89 years in order to avoid the possibility of an integer overflow.

Assuming a valid date is given, the date is then converted to a single integer ZX and the subroutine terminates. The returned value, ZX, is used for storing the date, and the dates stored in this form can be sorted in chronogical order by an integer sort. All the variables used in these subroutines commence with the letter Z, which makes it relatively easy to include them in any program without corrupting the other variables used.

The second subroutine is called when it is required to convert a date which is stored in the computed integer form to a string, for printing. For this purpose ZX must contain the computed integer when the subroutine is called and, on return, ZX$ will contain the date in a form suitable for printing. In addition, variables ZD,ZM & ZY will contain the day, month and year respectively.

At any time, the day-of-week may be calculated by using the function FNDay(X), where X is the date in the computed integer form used in this program: on initialisation the array ZD$( ) is set up with the days of week, ZD$(1) being the day on which January 1 in year Z1 falls, and so on. Using the Mod operator, it is then a relatively simple matter to come up with the day-of-week for any day.

MBasic Mod operator gives the remainder after an integer division. The subroutines may be run with other versions of Basic which do not include Mod by using floating-point variables, and by replacing X Mod 7 by

(X — (7 * INT(X/7)))

and If (X Mod 4 = 0) by

IF (X/4 = INT(X/4))

Handling dates.

```
100 '   INITIALISATION FOR DATE ROUTINES
110 DEFINT Z:DEF FNDAY$(Z) = ZD$(Z MOD 7)
120 DIM Z(12),Z$(12),ZD$(6):FOR Z = 1 TO 12:READ Z$(Z),Z(Z):NEXT
130 Z1 = 65:ZN = 82 ' Z1 is first year, ZN is last year
140 ' first set up array ZD$()
150 Z = 0:FOR ZZ = 1 TO Z1-1:IF (ZZ MOD 4 = 0) THEN Z = Z + 366
      ELSE Z = Z + 365
160 NEXT:ZZ = Z MOD 7:IF ZZ = 0 THEN ZZ = 7
170 FOR Z = 7-ZZ TO 6:READ ZD$(Z):NEXT
180 IF (ZZ <> 7) THEN FOR Z = 0 TO 6-ZZ:READ ZD$(Z):NEXT
190 GOTO 1000 ' main program
200 DATA JAN,31,FEB,,MAR,31,APR,30,MAY,31,JUN,30,JUL,31,AUG,31,
      SEP,30,OCT,31,NOV,30,DEC,31
210 DATA MON,TUE,WED,THU,FRI,SAT,SUN
220 '
      INPUT A VALID DATE & COMPUTE DATE-INTEGER ZX
230 INPUT "Day (1..[28/31]) ? ",ZD
240 INPUT "Month .. (1..12) ? ",ZM
250 INPUT "Year ..... 19",ZY
260 IF (ZM < 1) OR (ZM > 12) THEN 370
270 IF (ZY MOD 4 = 0) THEN Z(2) = 29 ELSE Z(2) = 28
280 IF (ZD < 1) OR (ZD > Z(ZM)) THEN 370
290 IF (ZY < Z1) OR (ZY > ZN) THEN 360
300 ' date is valid, so compute ZX
310 ZX = (ZY - Z1) * 365:IF (ZM < 3) THEN ZZ = ZY - 1
      ELSE ZZ = ZY
320 ZL = 0:FOR Z = Z1 TO ZZ:IF (Z MOD 4 = 0) THEN ZL = ZL + 1
330 NEXT ' ZL gives the number of leap-days encountered
340 Z(2) = 28:FOR Z = 1 TO ZM:ZX = ZX + Z(Z-1):NEXT
350 ZX = ZX + ZD + ZL:RETURN
360 PRINT "Date entered is out of range - try again":GOTO 230
370 PRINT "Date entered is invalid - try again":GOTO 230
380 '
      WITH ZX COMPUTE DATE-STRING ZX$ (ALSO ZD,ZM,ZY)
390 ZZ = ZX:ZY = Z1
400 IF (ZY MOD 4 = 0) THEN Z = 366 ELSE Z = 365
410 ZZ = ZZ - Z:IF (ZZ > 0) THEN ZY = ZY + 1:GOTO 400
420 ZZ = ZZ + Z:ZD = 0
430 IF (ZY MOD 4 = 0) THEN Z(2) = 29 ELSE Z(2) = 28
440 FOR Z = 1 TO 12:ZD = ZD + Z(Z):IF (ZD >= ZZ) THEN ZM = Z:
      ZD = ZZ + Z(Z) - ZD:Z = 12
450 NEXT
460 ZX$ = RIGHT$(STR$(ZD),2) + " " + Z$(ZM) + STR$(1900 + ZY)
470 RETURN
```

SHARP MZ-80K

Print At command

THIS SHORT ROUTINE by Piers Hendrie of Cambridge is for MZ-80K users who do not use an extended Basic. It will enhance the Sharp Basic SP-5025 to enable it to have a very useful form of the Print At command. The routine has the format: PRINT (X,Y); "SHARP, First and Foremost". The routine saves typing in all those reverse-field cursor arrows that waste so much time and memory. After you have entered and run the routine, you can save a new copy of Basic with the two USR calls 33 and 36 decimal. Do not save the new Basic over Sharp's Basic in case there is an error.

Print At command.

```
100 DATA 205,139,22,91,69,28,205,169
110 DATA 25,123,254,25,210,152,19,50
120 DATA 114,17,205,154,22,44,205,169
130 DATA 25,123,254,40,210,152,19,50
140 DATA 113,17,205,154,22,93,195,69,28
150 FOR I=15836 TO 15876
160 READ E
170 POKE I,E
180 NEXT I
190 POKE 7221,220
200 POKE 7222,61
210 POKE 4354,5
220 POKE 4355,44
230 POKE 4350,65
240 POKE 4351,13
250 PRINT [12,15];
      "Continue..."
```

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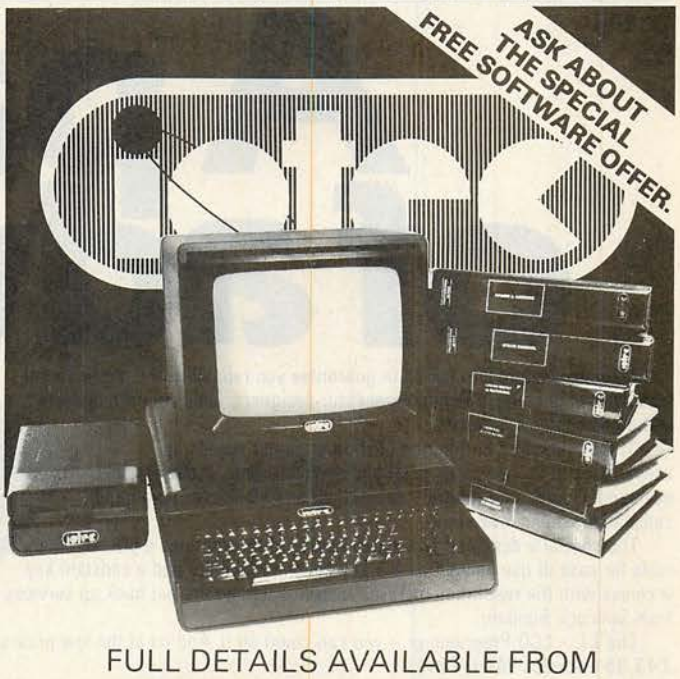

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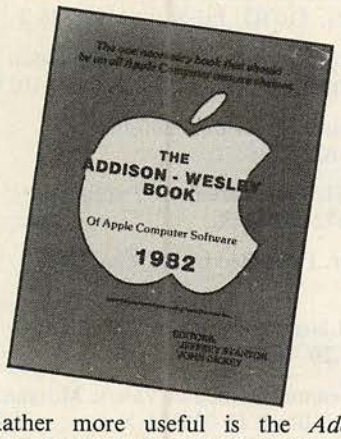
An average crop

Michael Trott evaluates a selection of Apple books

THE APPLE II has been a popular machine with business and educational users for many years and, as those who have access to one will know, every aspect of its use and every extra card or peripheral seems to have its own separate guide. *The Apple II User's Guide* brings these together in one relatively compact and comprehensive book covering setting up, programming in Basic, and use of discs, graphics, sound and machine language in no greater depth than the various guides provided with the equipment.

At first glance it would seem of little value though some readers may feel that it provides a more convenient reference than several separate books. The text is clearly written and attractively presented but it is a pity that the author's literary skills could not have been directed towards producing something newer and more exciting.



Rather more useful is the *Addison Wesley Book of Apple Computer Software,* described by the publishers as, "the one necessary book that should be on all Apple computer owners' shelves". Something of an exaggeration perhaps, but the book could be of value to those seeking software for their micro, listing as it does the sources of several hundred business, education, utility and games programs.

Actually the book goes further than this by providing reviews of the software with an indication of its usefulness, reliability, visual appeal, adequacy of documentation and availability. The reviews are thorough, well considered and often quite critical and amusing. Unfortunately, this is an American publication and the prices which are quoted in dollars may prove misleading in Britain. Since the source of much of the software is also American one might also question its availability. A call to my local Apple dealer confirmed that most of those with a high availability rating can be obtained easily from any good dealer, making this a useful book for the software hunter.

Also to be recommended is Howard Berlin's *Circuit Design Programs for the Apple II.* The author has written a similar book for the TRS-80 reviewed in an earlier issue of *Practical Computing.* Berlin's aim in writing the book is summed up when he quotes Leibnitz: "It is unworthy of excellent men to lose hours like slaves in the labour of calculation". He has achieved this aim by producing a useful guide to the use of the Apple for those involved in designing electronic circuits.

There are bound to be some bad books in any collection. Take, for example, *Mostly Basic: Applications for your Apple II Book 2* by Howard Berenbon. It is also available for the TRS-80, meaning that Mr Berenbon has produced not one but two truly awful books. Since it contains singularly unoriginal programs and many repetitions this is a book to avoid.

Not much to laugh about in the previous book, but *I Speak Basic to My Apple* by Aubrey B Jones Jr contains some real howlers. Described as a field-tested computer-literacy course it is really an introductory text for teaching Basic. The Teachers' Manual reviewed claims that the course was developed for use by teachers with little or no experience of computers. Leaving aside the issue as to whether this situation should ever be allowed to arise, any teacher in this position who attempts to use this text is unlikely to encourage good programming habits or any real understanding of computers.

My quarrel is not so much with the lesson content, which is no better or worse than many other similar introductory texts, but with the notes for teachers on how to present the work. Advice of the form: "You might like to have an Apple II available", when explaing the keyboard; "Make sure the class knows what a compiler does", when describing the interpreter; and best of all "If you do not know anything about RAM or ROM, don't worry about it", are just a few of many idiotic suggestions. Please, please do not allow this book through the school gates.

Apple Interfacing on the other hand is a much more interesting and useful book. Having previously produced similar texts for the TRS-80 the authors use their experience to lead the reader carefully through the 6502 processor and the basic principles of interfacing to the construction of a general-purpose interface which provides the opportunity for further experiments.

It is fair to point out that it is necessary to

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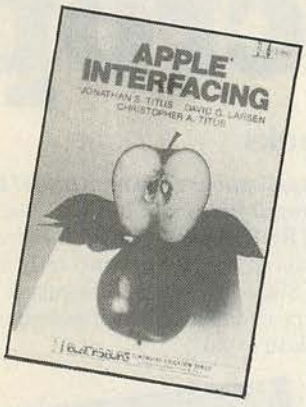
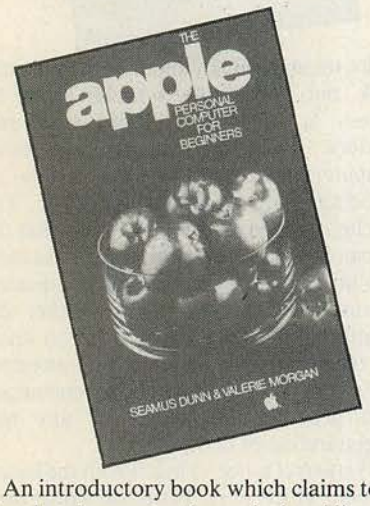


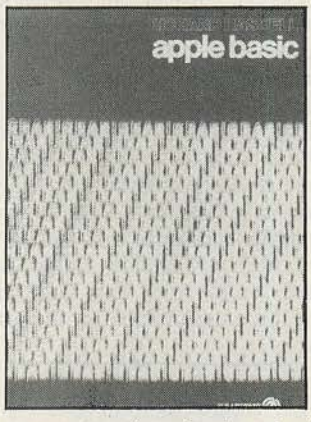
build the interface to learn the most from the book, and from my experience in building the TRS-80 interface this is likely to cost in the region of £100. But if you are prepared to go to the expense the work involved will result in a very versatile and adaptable interface. Although the book is not for real novices at interfacing and electronics, readers with some understanding of the principles of computer architecture will find it a useful extension to their knowledge.



An introductory book which claims to be aimed at the non-mathematical and lives up to that claim deserves to be commended. Such a book is *The Apple Personal Computer for Beginners* by Seamus Dunn and Valerie Morgan. In compact and carefully sequenced chapters the authors provide a sound introduction to the Apple and programming in Basic to bridge the gap between the manufacturer's manual and a Basic text.

The topics covered include starting up, programming, disc management, graphics, introducing machine code and producing a structured program. The listings provided are clear and easy to read and the inclusion of answers to the exercises set marks a refreshing if unusual departure from the practice of many auithors. Experienced users will find nothing particularly new or exciting in this book but careful reading will reveal that the authors have taken an established product and produced a no-frills introduction for the possibly wary potential user.

Rather less well presented is Richard Haskell's *Apple Basic*. Covering much the same ground as Dunn and Morgan the author provides a more comprehensive explanation of the concepts involved but assumes a higher level of mathematical ability. *Apple Basic* is liberally sprinkled with black-and-white photographs of the screen, mainly of program listings, which are frequently of poor quality and detract from rather than enhance the effect of the book.



As a course text for schools and colleges, for which it is intended, the book may be regarded as unsuitable due to its heavy reliance on examples of American origin — using as they do dollars and cents and the stars and stripes. The lack of relevance of these examples, from a teaching point of view, is perhaps less serious than the book's reliance on examples which presuppose a level of mathematical ability which may not be present in many pupils, who may still be able to learn to write programs proficiently if the material were better presented.

However the book has its good points, notably in its treatment of loops in which the idea of Do-While, Do-Until, Repeat-While and Repeat-Until loops is clearly explained by drawing a comparison with train tracks with branch lines and stations. Unfortunately the bad points, including the price of £10.35 for 183 pages, outweigh the good.

Aimed at those wishing to extend their programming skills and to make more effective use of their micro *Assembly Language Programming for the Apple II* by Robert Mottola attepts to provide an introduction to this topic. To a large extent he is successful. Topics covered include entering and editing code, assembling a source code, labels, registers and different addressing modes The book is well set out and written in a clear and sensible manner, and will undoubtedly assist the reader in making sense of more detailed books on the 6502 processor.

Finally a games book, *Golden Delicious Games for the Apple Computer* is more than a collection of computer games. It contains advice and techniques for creating games on the Apple. Starting at novice programmer level the authors demonstrate how to build general-purpose routines for music, high- and low-resolution graphics and entering data to incorporate into complex games.

The advice given is sound and should lead to the production of well structured programs. If the routines appear rather longer than necessary this is because they are presented in a form that can be easily understood, making this a very good beginners book.

The Apple II User's Guide by Lon Poole, Martin McNiff and Steven Cook. Published by Osborne/McGraw-Hill, 385 pages, £10.95. ISBN 0 931988 46 2.

The Addison-Wesley Book of Apple Computer Software edited by Jeffrey Stanton and John Dickey. Published by The Book Company, 401 pages. ISBN 0 201 10279

Circuit Design Programs for the Apple II by Howard M Berlin. Published by Howard W Sams, 132 pages, £10.90. ISBN 0 672 21863 1.

Mostly Basic: Applications for Your Apple II by Howard Berenbon. Published by Howard W Sams, 217 pages, £9.05. ISBN 0 672 21864 X.

I Speak Basic to My Apple by Aubrey B Jones Jnr. Published by Hayden Book Company, £6.55. ISBN 0 8104 6165 X.

Apple Interfacing by Jonathon S Titus, David G Larsen and Christopher A Titus. Published by Howard W Sams, 206 pages, £8.20. ISBN 0 672 21862 3.

The Apple Personal Computer for Beginners by Seamus Dunn and Valerie Morgan. Published by Prentice Hall, 257 pages, £4.95. ISBN 0 13 039131 X.

Apple Basic by Richard Haskell. Published by Prentice Hall, 183 pages, £10.35. ISBN 0 13 039 099 2.

Assembly Language Programming for the Apple II by Robert Mottola. Published by Osborne/McGraw-Hill, 143 pages, £9.50. ISBN 0 931988 51 9.

Golden Delicious Games for the Apple Computer by Howard M Franklin, Joanne Koltnow and Leroy Finkel. Published by John Wiley and Sons, 150 pages, £8.75. ISBN 0 471 09083 2.

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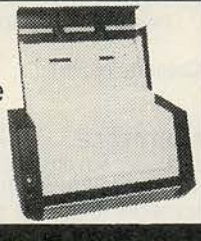

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Printer's error*?*

by Douglas Tate

```
10 DIM Z(9)
20 FOR X=1 TO 9 STEP 1
30 READ Z(X)
40 NEXT

310 FOR Z=1 TO 9
320 P.Z(X);"$";LEFT$(X,3)
330 NEXT

1210 DATA A,B,C,D,E,F,G,H,I,
```

ATICATOC
BFANCHIPS
CCALFINEORDC
DCTINGISORRID
EPRAMISEDTOBYMEA
FTASBIGASBOXES
GINGMENOWMAVIS
HPUTISANDINISPOCKIT
ICOMGREYMALKIN

NOW SIR, you say that your printer is playing up. Listing looks OK except that you have nothing to put the bits in order at the end. Ah, so that is the printout — as far as I can see there is a command gone wrong and a symbol missed out — both in the same line. It's not the printer sir. Now, which computer have you got? Oh, one of those, well that explains it, doesn't it sir!

Solution to February puzzle

GMRA'ANA = anagram = number of digits in each binary line. Each page of the drawing contains eight, seven-bit binary numbers. With this list of 32 codes add 32, the ASCII code for space.

The numbers resulting are codes for letters:

65 — 97, a
85 — 117, u
67 — 99, c
84 — 116, t
85 — 117, u
51 — 83, S
83 — 115, s
0 — 32, space
79 — 111, o
80 — 112, p
65 — 97, a
85 — 117, u
76 — 108, l
71 — 103, g
0 — 32, space
69 — 101, e
1 — 33, !
65 — 97, a
48 — 80, P
57 — 89, Y
0 — 32, space
84 — 116, t
77 — 109, m
73 — 105, i
79 — 111, o
35 — 67, C
82 — 114, r
84 — 116, t
73 — 105, i
76 — 108, l
78 — 110, n
67 — 99, c

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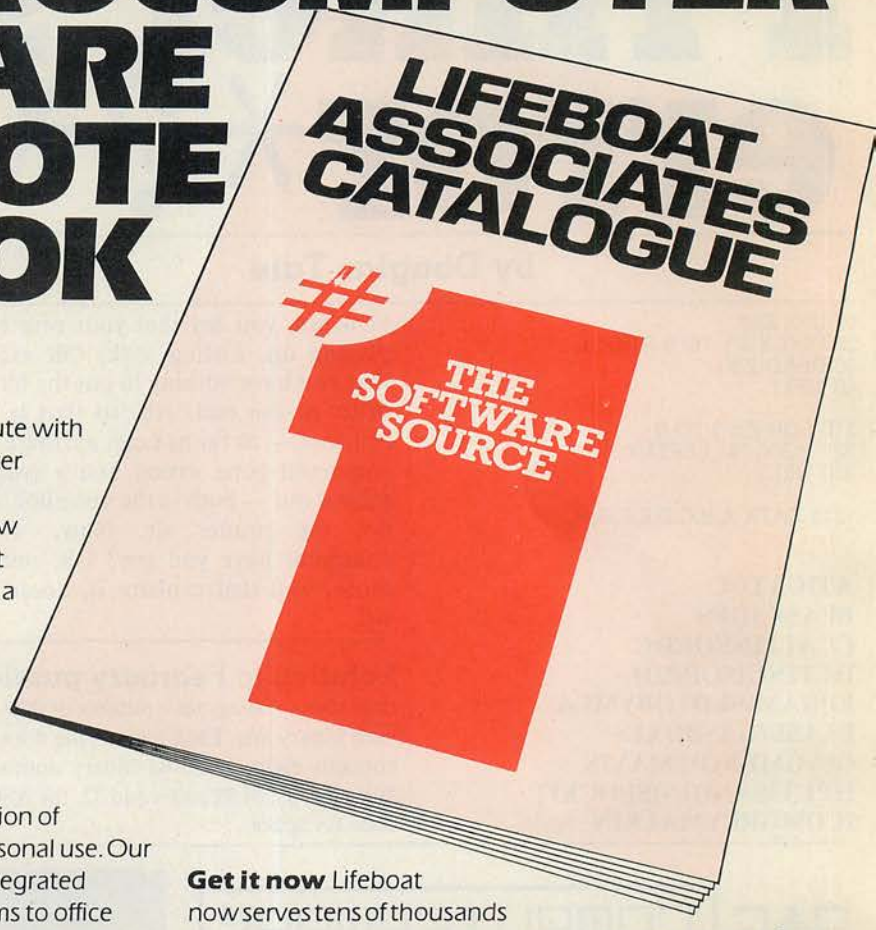

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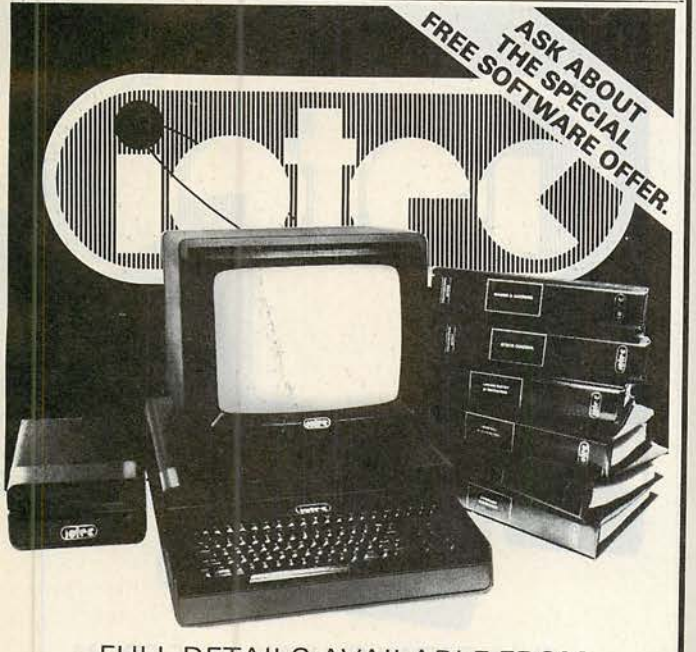

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>NEXT MONTH

>LANGUAGES

The special feature section of the April issue of *Practical Computing* will be devoted to the most popular and most important microcomputer languages, including a survey of Basic dialects. If you are looking for an alternative to Basic then don't miss our coverage of APL, Cobol, Forth, Lisp, Logo, Pascal and Prolog. We'll be looking at their strengths, weaknesses and possible applications, together with their potential for the future.

A comprehensive table will tell you which languages are available for which machines.

>BUSINESS MICROS

The major products tested include the Olivetti M-20 and Cifer Series 1 microcomputers. The Olivetti is a 16-bit machine which is unusual in using the Zilog Z-8000 processor — and it's fast. The Cifer is a British CP/M micro that has a novel and interesting architecture, and yes, it can be 16-bitted.

>AND MUCH MORE!

- Word processing on home micros — we take a detailed look at some of the programs available, including the "word processor on a chip" for the BBC machine.
- A comprehensive guide to machine-code programming on the Sinclair Spectrum.
- Plus all the usual reviews and departments including all the programs in Open File, news and your letters.

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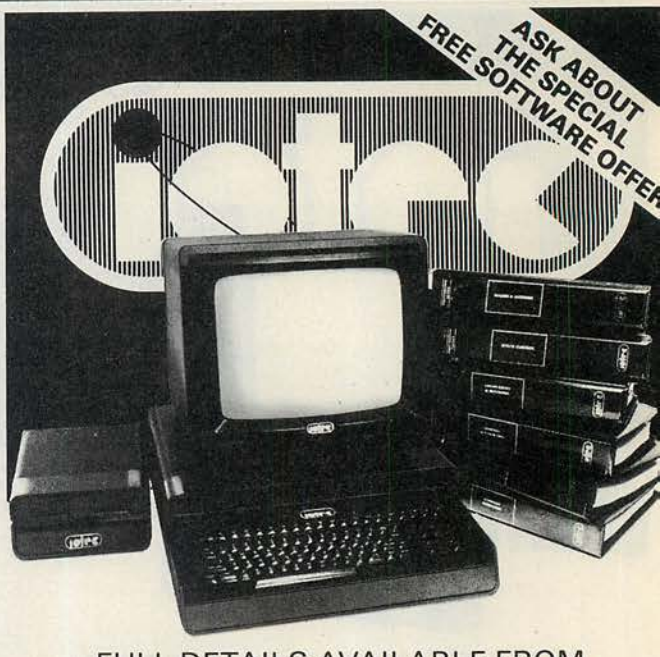

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A bit far-fetched

by Peter Laurie

IT HAS LONG BEEN TRUE in our industry that what you see advertised and what you can buy are two totally different things. The two are now moving so far apart that a new rule has to come into operation: "If it isn't obsolete, you can't get it and you wouldn't want it if you had it."

This sour conclusion is prompted by a recent attempt to bring to you, gentle reader, a review of the 16-bit operating systems. To judge by the printed word, 16 bit has come and gone: but even so we thought it might be a good idea to asemble in one spot machines running CP/M-86, MS-DOS, Xenix and whatever. Well, after very energetic attempts by many persons what arrived on the day was a single, battered IBM PC running PC-DOS. Its colour did not work and no one knew how to mend it. As for the others, it was as if they had never been.

PC-DOS looks like CP/M but with some very annoying frills. When you turn the machine on, it does nothing for long enough to convince you that it has broken in some fundamental way — long enough, in fact, for you to start ringing those who know and love it, if there be any such. No, it hasn't broken, it's just that every time you reboot it has to test all its memory to see that nothing got sick in the night. Then you have to go through one of those infuriating interrogations about who you are and what date it is — being careful to type in the date in American order with redundant zeros — just the way you would never do it if left on your own.

After 20 years of computing, has no one the wit to write a program that understands "04" is the same as "4"?

All this agony, and it then runs some pretty stolid business software. The stuff is beautifully packaged, I will give it that. The manuals are nicely printed with many neat drawings of where to put your puddy fingers on the keys. They are those grey blobs with letters on them. Do you know what l e t t e r s are? Who's a clever boy then!

The silk screening on the plastic binders rises, in some cases, to an art form. The binders arrive inside cloth-textured boxes. The whole thing has evidently been packaged by someone whose last job was producing "old master" editions of the classics for sale to readers of Sunday colour magazines. The packaging is impressive; the software not terribly.

There was one exception: a scrawled-on disc with three tattered pages of manual had a most impressive real-time simulation of flying a light aeroplane. The instruments worked and the whole thing behaved aerodynamically Even the countryside was in three dimensions with a huge pylon thing to fly into if you wanted an early death. It is the only piece of software I have seen which could not possibly have run on an eight-bit machine. But, again, it was just as boring as actually flying about in a Piper Cub or some such.

In an attempt to bring you some more solid news, I talked to two people who had implemented MS-DOS, Microsoft's answer to CP/M-86. They said it was alrightish, but there was a little problem about files. What sort of problem about files? Oh, nothing much. Just that it will not allow you to have files bigger than 200K. I suppose that does not matter much at the moment because most 16-bit machines have tiny discs. If you want to do serious data processing you have to buy an eight-bit machine.

Another reason I wanted to see MS-DOS was a utility described in Microsoft's brochure which would turn Z-80 code into 8086 code. As the proprietor of some eight-bit software that many people urgently want converted in this way, I was most interested. On the day, it did not appear. Calls to Microsoft produced no news of it. Evidently the man who printed the brochure had thought it would be a nice idea and would cheer everyone up, so he threw it in. It will appear, we are told, with MS-DOS 1.2 or 2 or whatever the next number is. When might that be? Who can tell.

The second operating system we wanted to look at was Xenix, a micro version of Unix. No problems about Xenix: it worked wonderfully, we would be most impressed. One small snag, though, the machine it was on was stuck in customs and had accumulated more warehouse costs than it was worth. The best thing seemed to be to abandon the machine to the warehouse owners. So much for Xenix.

The third was CP/M-86, which one is realiably informed works just like CP/M-80 — that's the sort we are are used to. There did not seem a lot of fun in that so I will not, for the moment, be writing a review of 16-bit operating systems.

Everyone is so hysterically frightened of being left at the post that they are announcing "products" that are no more than a gleam in someone's eye. The result is a most unnerving kaleidoscope of whirling progress, made all the more alarming as you can never see any evidence for it. Anywhere.

Evidently, everyone thinks that the opposition must be so far ahead that they are out of sight, and this spurs them to even greater heights of pre-announcement.

Yet there is, as we have discovered over the last few months, a sensible core of people with real jobs to do and real needs for well-established products. They realise that the 16-bit machines may, one day, be very nice, but for the moment they are embryonic. They will make do perfectly well with what eight bits can do for them. When there are lots of people around using 16 bits, lots of dealers who understand them and lots of software for them, then it might be sensible to change. But then one reflects that the "16-bit revolution" burst on us two years ago and has yet to arrive.

It is up to the micro journals to try to keep things on the rails. Normally it is the function of the press to tell of what is new and exciting; in this odd business it should be its function to tell of what is old and reliable. Journalists must realise that an announcement or even a prototype of a new machine or a new software system is only the beginning. It may catch on or it may not. Its builders may be able to supply customers' demand or they may not. It may need some accessory which other people have to supply, and they may not.

The problem from the journalists' point of view is that this makes for rather boring material. There are, depending on whose fingers you count, some 20, 50, 100 magazines and papers competing for the attention of a new mass market interested in computing. It is a rule of computing that the less you know about it, the more you expect. You and I know enough about it to be pleasantly surprised by a successful run of address labels; newcomers expect something more exciting than that. There are too many journalists and PR people willing to oblige them, and in the end the result will be a vast amount of confusion and disappointment.

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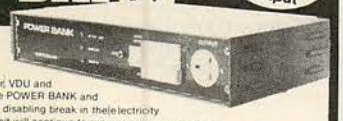

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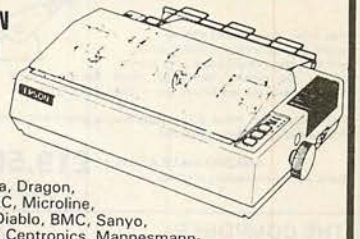

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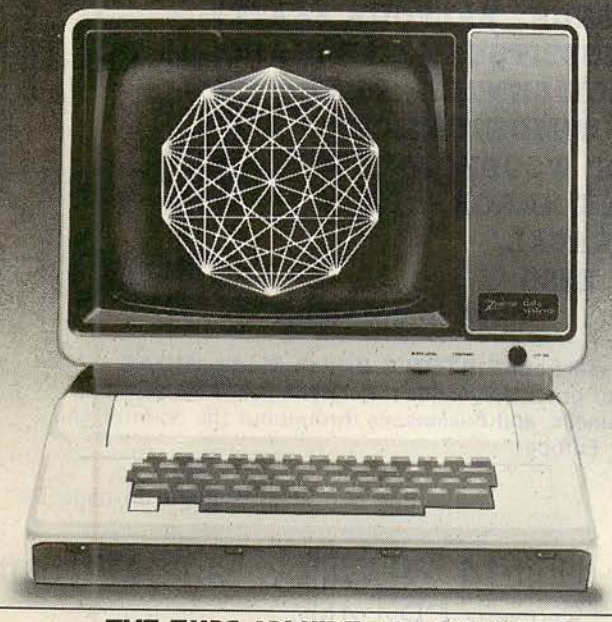

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